From: Mike Moran [moran3@llnl.gov]
Sent: Wednesday, August 13, 2008 5:52 PM
To: vgle
Subject: Fwd: Gamma Bang Time and hard X-rays

>Date: Mon, 25 Sep 2006 17:32:20 -0400
>To: jmmack@lanl.gov, "Hans W. Herrmann" <herrmann@lanl.gov>
>From: Vladimir Glebov <vgle@lle.rochester.edu>
>Subject: Gamma Bang Time and hard X-rays
>Cc: lerche1@llnl.gov, Mike Moran <moran3@llnl.gov>,
> Craig Sangster <csan@lle.rochester.edu>, csto@lle.rochester.edu,
> "Colin Horsfield" <c.j.horsfield@awe.co.uk>
>X-LLE-MailScanner: Found to be clean
>
>Dear Joe and Hans,
>
>Since you are presenting some Monte Carlo calculations about GBT this
>Thursday, I want share some supplemental information from HYNTD.
>
>I want to determine a maximum sensitivity of HYNTD to neutron in
>scintillator + PMT mode. Something like neutron bang time detector
>based on Light Pipe.
>I run HYNTD with 5 mm scintillator and PMT with 1 E6 gain. I turn HYNTD
>on earlier just to check data acquisition system and to my surprise
>recorded some signal in non-neutron shot. First I think that we have a
>light leak. To check this, we remove scintillator and recorded empty
>HYNTD on shot 44859. There is no light lead, but there are some 20 mV
>hits. If this will be a neutron shot, I will say a single neutron hits,
>but it was no neutrons at all. The shot
>44859 and 44861 are Fast Ignition shots with empty plastic shell and Au
>cone. See slide with target design. Laser beams hit only shell and
>doesn't hit gold cone. Anyway, there is no neutrons in these shots.
>Could somebody explain to me the nature of these 20 mV hits?
>
>It happened that hot electrons from laser interaction with plastic
>shell interacts with gold cone and produce hard X-rays. See hard X-ray
>detector output for shot 44861. For this shot HYNTD scintillator + PMT
>produced 2.5 V signal in each of scope channels
>(5 V total). For such gold cone targets a 3 mm thick W is not enough.
>Hard X-rays from gold cone easily penetrate 3 mm tungsten.
>
>I choose 3 mm of W as a hard X-ray shielding because NTD has 2 mm W and
>we never see hard X-ray signal on NTD in direct drive. (Indirect drive
>is another story). In some sense this is a "gold" experiment that Joe
>was talking long time ago.
>
>For the regular direct drive D2 shots without gold cone HYNTD see no
>X-rays, just a neutron signal. See shot 44863 with D2 yield 3 E9 and
>44945 with DT yield 2.8 E10. Therefore, 3 mm W is good for direct drive
>implosions and not enough for indirect drive.
>
>You may say that this gold cone is very thick and produced more hard
>X-rays that a normal hohlraum. This is true for scale 1 hohlraum and

>PS26 pulse. But LLNL is planing to use gas filled hohlraum. And gas may
>increase hard X-ray signal by 1000 times. See HXRD output for shots
>44560 and 44562. Shot 44560 is vacuum scale 1 Au halfraum with
>PS26 pulse and 13.5 kJ energy. Hard X-ray signal is low. Shot 44562 is
>gas filled scale 1 Au halfraum with PS26 pulse and 13.6 kJ. As you can
>see hard X-ray signal in all channels increased by factor of 1000. This
>is a prise we will pay to increase radiation temperature in halfraum on
>17 eV.
>
>You can see that hard X-ray level for shot 44861 is comparable with
>shot 44562. And this is only for 13 kJ. What kind of hard X-ray signal
>will be on the NIF?
>
>Yes, you may say that this is a signal from scintillator and from
>CO2 it will be no signal at all.
>But the story with GCD2 make me skeptical. Yes, we need to check signal
>in CO2 version of HYNTD with indirect drive shots. I will do it at
>first opportunity.
>
>But then you will optimize GBT converter for the NIF do it after a lead brick!
>
>Thank you,
>
>----------
>Dr. Vladimir Glebov,
>Senior Scientists,
>Laboratory for Laser Energetics,
>University of Rochester,
>
>250 E. River Road,
>Rochester, NY 14623-1299
>
>Phone 585-275-7454
>Fax 585-275-5960
>
>Attachment converted: Mac HD 30GB:FI_cone.ppt (SLD3/PPT3) (0036A510)
>Attachment converted: Mac HD 30GB:44859_hyntdpmt.pdf (PDF /CARO)
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>converted: Mac HD 30GB:44560_hxrd.pdf (PDF /CARO) (0036A515)
>Attachment converted: Mac HD 30GB:44562_hxrd.pdf (PDF /CARO)
>(0036A516)

From: Mike Moran [moran3@llnl.gov]
Sent: Wednesday, August 13, 2008 5:52 PM
To: vgle
Subject: Fwd: NTD and HYNTD

>Date: Wed, 27 Sep 2006 11:16:58 -0400
>To: "Hans W. Herrmann" <herrmann@lanl.gov>
>From: Vladimir Glebov <vgle@lle.rochester.edu>
>Subject: NTD and HYNTD
>Cc: Craig Sangster <csan@lle.rochester.edu>, Mike Moran <moran3@llnl.gov>,
> lerche1@llnl.gov, "Joseph M. Mack" <jmmack@lanl.gov>,
> csto@lle.rochester.edu
>X-LLE-MailScanner: Found to be clean
>
>Dear Hans,
>
>This is a quick update on status of NTD and HYNTD.
>
>The NTD streak camera was fixed and reinstalled in the Target Bay yesterday.
>We recorded fiducial on NTD and will test NTD on a real shots this Friday.
>The NTD timing calibration was lost because of streak camera delay was
>changed after repair. We will try to re-calibrate NTD as soon as
>possible after next week shots and re-calculate bang time after
>calibration. But burn width and double pulses (if produced) can be
>recorded by NTD now. Only absolute bang time is compromised.
>
>I have seen that you ordered a separate fiducial line for GCD1. This is
>fine in a long run.
>But without calibrated NTD on October 4th may you should use the old,
>calibrated fiber for GCD1.
>
>HYNTD front light pipes were modified for CO2 and tested at 150 psi.
>We will run HYNTD in scintillator + PMT mode this Friday. Final
>assembly and in situ test of CO2 version is scheduled on Monday.
>
>Thank you,
>
>----------
>Dr. Vladimir Glebov,
>Senior Scientists,
>Laboratory for Laser Energetics,
>University of Rochester,
>
>250 E. River Road,
>Rochester, NY 14623-1299
>
>Phone 585-275-7454
>Fax 585-275-5960

From: Mike Moran [moran3@llnl.gov]
Sent: Wednesday, August 13, 2008 5:52 PM
To: vgle
Subject: Fwd: Re: Oct 4 Shots

>Date: Tue, 12 Sep 2006 20:16:07 -0400
>To: "Hans W. Herrmann" <herrmann@lanl.gov>
>From: Vladimir Glebov <vgle@lle.rochester.edu>
>Subject: Re: Oct 4 Shots
>Cc: jmmack@lanl.gov, "Colin Horsfield" <c.j.horsfield@awe.co.uk>
>X-LLE-MailScanner: Found to be clean
>
>Dear Hans,
>
>Please find attached HYNTD signal from 5 mm BC-422 scintillator and
>Hamamatsu R3809U-52 PMT (gain 1 E6) recorded today (5 minutes ago) on
>two channels of 1 GHz TDS 684 scope. Shot 44848 is DT cryo shot with
>yield 5 E11. Shot 44850 is D2 shot with yield 1.3 E9.
>
>You can see we have a lot of signal from PMT when 100 light go to PMT.
>I think with ROSS and PMT we have two problems in July. First, light
>was splitted not 90%/10% but 99%/1% or less, so very low fraction of
>light reached PMT. Second, we don't know how to collect/focus light on
>ROSS.
>
>In addition, there are some extra signal after first pulse. We will try
>to solve all these problems by October.
>As you can see, HYNTD is not finished diagnostic yet. It need some
>tunings and adjustments.
>
>Thank you,
>
>At 12:30 PM 9/12/2006, Hans W. Herrmann wrote:
>>Vladimir,
>>
>>I agree, NTD will be the main reference diagnostic.
>>
>>Our primary interest in HYNTD is the CO2 option to provide reference
>>data as we enter into the Gamma Bang Time/Reaction History CDR
>>process. Thus it is probably even more important that we obtain data
>>from it during the high-yield shots for NIS than during the Double
>>Pulse experiment. If CO2 is not ready by Oct, then of course we will
>>have to be satisfied with scintillator data.
>>
>>I think it would be preferable to run with both streak camera and PMT,
>>although I believe there was some question as to how much actual
>>transmission there was through the splitter to the PMT. We may have a
>>higher gain, 2-stage MCP available if light levels are as low as they
>>were last time, but would prefer to run with the faster single stage.
>>I leave it to you and Joe to hammer this out.
>>
>>This will be a normal shift, so 14 shots certainly is ambitious. I
>>have agreed to switch over to the NIS shots no later than 4 pm, so I

>>hope to get a minimum of 5 shots for Double Pulse and 5 shots for NIS.
>>
>>Thanks for the heads up on 30 vs 27kJ.
>>
>>thank you,
>>Hans
>>
>>At 04:15 PM 9/11/2006, Vladimir Glebov wrote:
>>>Dear Hans,
>>>
>>>Thank you for information about shots on October 4, 2006.
>>>
>>>I think the main reference diagnostic for your Double Pulse
>>>experiment will be NTD, not HYNTD. The 5 E12 yield and time
>>>separation between pulses match good NTD parameters.
>>>
>>>Our plans are to prepare HYNTD in CO2 option by October. This option
>>>is not manufactured yet, we will try to finish it by October, but
>>>there is no guarantee. What mode (scintillator or
>>>CO2) do you have in mind then you refer to Light Pipe?
>>>
>>>If CO2 option will be ready we can run HYNTD in CO2 + only PMT (100%
>>>light to PMT) mode. This option is similar to GCD1 but in different
>>>geometry. Is this what you want?
>>>
>>>You experimental plan looks very challenging for me. Is it a normal
>>>or extended shift? It is very difficult (practically
>>>impossible) to have 8 Double Pulse + 6 high yield shots in a normal
>>>12 hours shift. You can create 14 SRF (just in case), but count on 10
>>>-12 shots. For shots without SSD you should request 30 kJ energy on
>>>target (not 27 kJ).
>>>
>>>Thank you,
>>>
>>>At 05:33 PM 9/11/2006, Hans W. Herrmann wrote:
>>>>Vladimir,
>>>>
>>>>As you know, we will be conducting high-yield DT shots on Oct 4.
>>>>There will essentially be two sets of experiments:
>>>>
>>>>1. We will start off with Double Pulse experiments looking for
>>>>structure in the reaction history. The expected yield is <=5e12
>>>>neutrons using Hoppe shells (~1000 um diameter, 3.8 um glass wall,
>>>>10 atm DT). The pulse width will be 0.6 ns (sg0604). The first pulse
>>>>will contain 10 kJ in 40 beams, followed by a 5 kJ pulse of 20
>>>>beams. The delay between the start of the pulses will vary between
>>>>0.7-1.0 ns. For diagnostic setup purposes, implosion times range
>>>>from 1.3 to 1.5 ns. I expect to run 8 of these shots.
>>>>
>>>>2. The second experiment will be high yield for Neutron Imaging.
>>>>We could get off as many as 6 of these shots (perhaps more if we
>>>>decide to abandon the Double Pulse experiment after a few shots due
>>>>to lack of expected results). There will only be 2 Hoppe shells left
>>>>after the Double Pulse experiment, which we expect to achieve yields
>>>>of >5e13 neutrons with a 1.0 ns pulse (sg1018) and
>>>>27 kJ (i.e. no SSD). The remaining 4 shells are drop towers, which
>>>>are expected to give somewhat lower yield, but hopefully >2e13.

>>>>
>>>>I understand Joe is coordinating with you on the Light Pipe which I
>>>>expect to be extremely useful for diagnosing the Double Pulse
>>>>experiment.
>>>>
>>>>I look forward to my first Omega PI experience on these upcoming
>>>>shots and would appreciate any advice you might have in making this
>>>>go smoothly.
>>>>
>>>>thanks,
>>>>Hans
>>>>
>>>>_____
>>>>Hans W. Herrmann, Ph.D., CDR (USNR)
>>>>P-24 Plasma Physics, M/S E526
>>>>Los Alamos National Laboratory
>>>>Los Alamos, NM 87545
>>>>herrmann@lanl.gov
>>>>505-665-5075
>>>>fax: 665-4409
>>>>
>>>>if Foreign correspondence: TSPA or Correspondence
>>>
>>>----------
>>>Dr. Vladimir Glebov,
>>>Senior Scientists,
>>>Laboratory for Laser Energetics,
>>>University of Rochester,
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>>>250 E. River Road,
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>Phone 585-275-7454

>Fax 585-275-5960
>
>Attachment converted: Mac HD 30GB:44848_hyntd.pdf (PDF /CARO)
>(00368925) Attachment converted: Mac HD 30GB:44850_hyntd.pdf (PDF
>/CARO) (00368926)

From: Mike Moran [moran3@llnl.gov]
Sent: Wednesday, August 13, 2008 5:53 PM
To: vgle
Subject: Fwd: Re: Oct 4 Shots

>Date: Mon, 11 Sep 2006 18:15:45 -0400
>To: "Hans W. Herrmann" <herrmann@lanl.gov>
>From: Vladimir Glebov <vgle@lle.rochester.edu>
>Subject: Re: Oct 4 Shots
>Cc: jmmack@lanl.gov, "Colin Horsfield" <c.j.horsfield@awe.co.uk>
>X-LLE-MailScanner: Found to be clean
>
>Dear Hans,
>
>Thank you for information about shots on October 4, 2006.
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>will be NTD, not HYNTD. The 5 E12 yield and time separation between
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>extended shift? It is very difficult (practically impossible) to have
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>>structure in the reaction history. The expected yield is <=5e12
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>>10 atm DT). The pulse width will be 0.6 ns (sg0604). The first pulse
>>will contain 10 kJ in 40 beams, followed by a 5 kJ pulse of
>>20 beams. The delay between the start of the pulses will vary between
>>0.7-1.0 ns. For diagnostic setup purposes, implosion times range from
>>1.3 to 1.5 ns. I expect to run 8 of these shots.
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>>could get off as many as 6 of these shots (perhaps more if we decide
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>>
>>I look forward to my first Omega PI experience on these upcoming shots
>>and would appreciate any advice you might have in making this go
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>>thanks,
>>Hans
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>>_____
>>Hans W. Herrmann, Ph.D., CDR (USNR)
>>P-24 Plasma Physics, M/S E526
>>Los Alamos National Laboratory
>>Los Alamos, NM 87545
>>herrmann@lanl.gov
>>505-665-5075
>>fax: 665-4409
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>>if Foreign correspondence: TSPA or Correspondence
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>----------
>Dr. Vladimir Glebov,
>Senior Scientists,
>Laboratory for Laser Energetics,
>University of Rochester,
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>250 E. River Road,
>Rochester, NY 14623-1299
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>Phone 585-275-7454
>Fax 585-275-5960

From: Mike Moran [moran3@llnl.gov]
Sent: Wednesday, August 13, 2008 5:53 PM
To: vgle
Subject: Fwd: Gamma Bang Time and hard X-rays sequel

>X-IronPort-AV: i="4.09,444,1157353200";
> d="pdf'?scan'208"; a="5412967:sNHT284929148"
>Date: Tue, 21 Nov 2006 16:00:52 -0500
>To: "Joseph M. Mack" <jmmack@lanl.gov>, "Hans W. Herrmann"
><herrmann@lanl.gov>,
> Mike Moran <moran3@llnl.gov>, lerche1@llnl.gov,
> Craig Sangster <csan@lle.rochester.edu>,
> Mike Cruz <mcru@lle.rochester.edu>, csto@lle.rochester.edu,
> "Colin Horsfield" <c.j.horsfield@awe.co.uk>
>From: Vladimir Glebov <vgle@lle.rochester.edu>
>Subject: Gamma Bang Time and hard X-rays sequel
>
>Dear Colleagues,
>
>On September 25, 2006 I have sent you a first E-mail with subject
>"Gamma Bang Time and hard X-rays". In that mail I showed that 3 mm
>tungsten cap is a good shielding for direct drive hard X-rays, but not
>enough to protect Light Pipe (or any Gamma Bang Time detector) from
>indirect drive hard X-rays. The September data were recorded with
>scintillator. The remaining question was about interaction of X-rays in
>CO2 cell. I promise to check CO2 signal in indirect drive shots at
>first opportunity.
>
>Such opportunity was last Friday in indirect drive Sandia shots. The
>HYNTD was re-assembled in CO2 mode with pressure 100 psi, 3 mm tungsten
>cap at 23 cm from TCC and all light directed to PMT with gain 1 E6. So,
>it was exactly the same configuration as in October
>2006 double pulse experiment except that different PMT with gain 2.6
>E5 was used in October and signal from PMT was split between two
>different scopes and was split into two scope channels in HYNTDPMT
>scope. Last Friday all signal was recorded in one scope channel and
>fiducial on the second channel.
>
>I am sending to you just two shots with the highest level of hard X-ray
>signal.
>Shot 45548 has a 3/4 hohlraum with 213 pC signal in the forth HXRD
>channel (>80 keV) and shot 45549 has a 5/8 hohlraum with 1521 pC signal
>in the forth HXRD channel.
>
>There is no signal in HYNTD for shot 45548 and two 40 mV and ~15 mV
>signals for shot 45549.
>
>These 4 files are new experimental data, the rest is
>interpretation/estimation/speculation.
>
>1) Hard X-rays have very little or not at all effect for C)2
>experiments on OMEGA.
>

>2) Effect on the NIF. Scale 1 hohlraum with gas and face plates
>produced at 13.6 kJ about 6.6 times less hard X-ray than shot 45549
>(see shot 44562, 1521/229 = 6.64). If we assume that hard X-ray signal
>is proportional to total beam energy, then on NIF we should expect 73.5
>times (1000/13.6) higher hard X-ray signal than in shot 44562.
>Therefore CO2 signal will be 73.5/6.6 = 11.1 times higher on the NIF
>than on OMEGA. Instead of 40 mV signal it will be 0.44 V signal.
>
>This 0.44 V hard X-ray signal should be compared with gamma ray signal
>in shot 45045 but scaled to unsplitted signal and different PMT gain.
>Therefore it will be (0.44V)x2x2 = 1.76 V signal scaled for two
>splitting and (1.76 V)x10/2.6 = 6.77 V corrected for PMT gain
>difference.
>
>Shot 45045 has neutron yield 2.78 E12, therefore hard X-ray signal will
>be on the NIF equivalent to gamma signal from implosion with
>(2.78)x(0.44/6.77) E12 = 0.18 E12 = 1.8 E11 neutron yield.
>
>So, on the NIF hard X-rays will generate in the CO2 cell shielded with
>3 mm tungsten signal equivalent to gamma signal from implosion with 2
>E11 neutron yield. Since Gamma Bang Time will be designed for yield
>greater than 1 E15, contribution from hard X-rays can be neglected.
>
>Conclusion: 3 - 5 mm tungsten is a reasonable shielding for CO2 cell on
>the NIF, but similar hard X-ray test should be performed on the NIF to
>prove it. We need such test in case if hard X-rays are not linear with
>energy.
>
>Thank you,
>
>----------
>Dr. Vladimir Glebov,
>Senior Scientists,
>Laboratory for Laser Energetics,
>University of Rochester,
>
>250 E. River Road,
>Rochester, NY 14623-1299
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>Phone 585-275-7454
>Fax 585-275-5960
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>Attachment converted: Mac HD 30GB:45045_hyntdpmt_s.pdf (PDF /CARO)
>(00371BEE)

From: Mike Moran [moran3@llnl.gov]
Sent: Wednesday, August 13, 2008 11:49 PM
To: vgle
Subject: Fwd: Re: GBT with Light Pipe in August 31

>X-IronPort-AV: i="4.16,527,1175497200";
> d="scan'208"; a="31154790:sNHT35199816"
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> d="scan'208"; a="28074695:sNHT29489340"
>Date: Wed, 11 Jul 2007 11:01:02 -0400
>From: Vladimir Glebov <vgle@lle.rochester.edu>
>To: Mike Moran <moran3@llnl.gov>
>CC: Richard Lerche <lerche1@llnl.gov>,
> Colin Horsfield <c.j.horsfield@awe.co.uk>,
> "Hans W. Herrmann" <herrmann@lanl.gov>,
> "Joseph M. Mack" <jmmack@lanl.gov>, Carl Young <csyoung@lanl.gov>,
> Mike Cruz <mcru@lle.rochester.edu>
>Subject: Re: GBT with Light Pipe in August 31
>
>Dear Mike,
>
>I don't understand your interest in measuring both fusion gammas and
>neutrons. Yes, interactions of neutrons with glass can produced fast
>signal. Dick published this many years ago. But all advantage of
>fusion gamma for bang time measurements is that detector can be located
>far away from target. Neutrons don't have such advantage.
>So, that the point to study neutron signal?
>Is glass a better converter for fusion gammas? I doubt it.
>Why carbon is better than Be? How this agree with theory?
>
>Thank you,
>
>Mike Moran wrote:
>>At 5:51 PM -0400 7/10/07, Vladimir Glebov wrote:
>>>Dear Colleagues,
>>>
>>>It will be one day of diagnostic development shots on August 31,
>>>2007. This is Friday, therefore end of the day will be at 5 PM and
>>>number of shots will be from 6 to 10. The expected yields are from
>>>1 to 3 E13.
>>>We have an opportunity to continue/finish GBT development based on
>>>Light Pipe.
>>>I have two subjects for GBT activity:
>>> 1) Finish converter optimization following May beryllium measurements
>>> 2) Make measurement with 2" tungsten cap and compare it with
>>>expected signal change because of different diameter and distance
>>>from TCC. We have all hardware ready for such measurement. I think it
>>>will be easier to scale 2" Light Pipe from start to finish to the NIF
>>>than current 1" to 2" configuration.
>>>
>>>Do you have any other ideas? I want your proposals for GBT shot plan.

>>>
>>>I personally, still don't understand May result with Be. It looks
>>>like 3 mm of W is the best converter of gammas to electrons? The W
>>>thickness of 3 mm was selected to protect HYNTD scintillator in
>>>direct drive shots. This is not enough thickness for scintillator in
>>>indirect drive shots. Probably it is too much thickness for CO2 cell
>>>on OMEGA. What is optimum for the NIF? Any calculations?
>>
>>Sure. We have lots of calculations. The only problem is that they
>>don't agree with the recent results very well. The difference in
>>performance between different gamma/electron converters wasn't very
>>large. Actually, the best seem to be pure carbon or polyethylene.
>>This makes me wonder about glass - it could be very interesting to use
>>leaded glass - this would give us very fast measurements of both the
>>fusion gammas and neutrons. Where are the leaded glass samples that I
>>had made? Were they sent to Los Alamos, too?
>>
>>There has been some movement here at LLNL recently with respect to
>>planning for a gamma bangtime detector on NIF. Nodthing definite yet,
>>but I will try to keep you informed when something happens.
>>
>>Mike
>>
>>>
>>>Thank you,
>>>
>>>--
>>>Dr. Vladimir Glebov
>>>University of Rochester
>>>Laboratory for Laser Energetics
>>>250 East River Road
>>>Rochester, NY 14623
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>>>Phone: 585-275-7454
>>>FAX: 585-275-5960
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>Laboratory for Laser Energetics
>250 East River Road
>Rochester, NY 14623
>
>Phone: 585-275-7454
>FAX: 585-275-5960

From: Cindy Christensen [cchristensen@lanl.gov]
Sent: Friday, September 10, 2004 11:02 PM
To: vgle
Subject: SRF numbers

16255-16269 are the RIDs for the DTRAT experiments tentatively scheduled for September 30th.
Cindy

From: Cindy Christensen [cchristensen@lanl.gov]
Sent: Sunday, June 26, 2005 9:51 PM
To: Vladimir Glebov
Subject: Re: CH Targets...

Vladimir Glebov wrote:

> Hello Gary,
>
> I returned from ICOPS today and immediately start working on targets
> for July 11 week shots.
>
> I have found that:
>
> 1) It is impossible to fill new DT(15)CH[15] target because of
> preparation for cryo DT shots on OMEGA.
>
> 2) Five DT(15)CH[20] targets exists in cryo storage from my May campaign.
> They are mounted and ready to shoot. The only problem that these
> targets are not very reliable. I shot 8 such targets in May and 3 out
> of 8 targets have very low yield (~E9 - E10) in comparison with
> "normal" yield of about
> 1 E13.
> The DT(15)CH[15] targets produced about 3 E13 yield six time out of six.
> We never have such high percent of failure before. It is probably bad CH batch.
>
> So, we can shoot these targets if you are willing to take a risk.
>
> Now, I am confused about shots on July 12, 2005. Currently there is 1
> SRF #
> 18451 labeled "Neutron Imaging/DTRAD", SRF # 18507 and 18508 labeled
> "SPARTEX", and many Cindy's SRF 18073 - 18083 labeled "High Z", all
> scheduled for July 12.
>
> When actually will be high yield shots? Who is main PI who will fill SRF?
> I am interesting in shot schedule, targets sequence, TIM availability etc.
> and trying to find right person.
>
> Thank you,
>
> At 03:19 PM 06/23/2005 -0600, you wrote:
> >Vladimir,
> >
> >At LLNL we talked about shooting a couple CH targets during our July
> >campaign. Do you know whether these will be available and what their
> >fills will be?
> >
> >Thanks,
> >Gary
> >--
> >Gary P. Grim
> >
> >Neutron Science & Technology

> >Los Alamos National Laboratory
> >P.O. Box 1663, MS H803
> >Los Alamos, NM 87545
> >Phone (505) 667-8985
> >Fax (505) 665-4121
> >E-mail mailto:gpgrim@lanl.gov
> >
>
> Dr. Vladimir Glebov
> University of Rochester
> Laboratory for Laser Energetics
> 250 East River Road
> Rochester, NY 14623
>
> Note: new area code !
>
> Phone: 585-275-7454
> FAX : 585-275-5960

Our original plan was to do NIS/DTRAT Tuesday and Wednesday mornings. The high Z campaign would take place Tuesday evening, and the Time Dependent Mix would occur Wednesday evening. There has been some uncertainty lately, because of some equipment that was broken. The last I heard, they wanted to go along with the original plan. Cindy

From: Gary P. Grim [gpgrim@lanl.gov]
Sent: Tuesday, June 28, 2005 1:13 AM
To: Vladimir Glebov
Subject: Re: CH Targets...

Vladimir,

Given that it will be mid-July and CH outgasses, it doesn't seem very promising.

We are running three campaigns over two days. The first half of each day will be DTRAT/NIS, with the second half of Tues. being High Z, and the second half of Wed. being TDMIX. I am the main PI for the DTRAT/NIS campaign. Cindy is the main PI for High-Z and George Kyrala is the main PI for TDMIX, I believe. This is the first time I've filled out SRF's, so I'm working through this with help, I apologize for the confusion this may have caused. There are three SRF's filled out for the Tues. & Wed. high yield shots that give an example of what we are doing. The balance will be done later this week.

Gary

Vladimir Glebov wrote:
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>
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>
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>
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>> Gary P. Grim
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>> Neutron Science & Technology
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Gary P. Grim

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E-mail mailto:gpgrim@lanl.gov

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Monday, August 07, 2006 9:09 PM
To: Steve Batha
Cc: Gary P. Grim
Subject: Re: high yield shots next week

Dear Steve,

I have edited all NIS/DTRAT shot request forms today.

I will explain next week all details of setup, do not worry about them.

I selected NTD for all shots. Yes, if yield will be too high it will saturate and no meaningful information can be extracted. But if for some reason yield will be lower than calculated then we will have bang time. Bang time information will be important for GCD1 and GCD2, and also for High Yield NBT that I will run.

I also add some other neutron diagnostics: NBT, neutron fluence array.
In fixed diagnostic I add Hard X-ray Detector to measure hard X-rays for GCD1 and GCD2.

IMPORTANT !

I checked also other pages. I think that Driver setting was completely wrong.
No driver or pulse shape was selected and SSD was ON. I take a liberty to change Driver page to the setting that I think is right. I selected SSD driver, SG1018 pulse shape (1 ns square) and SSD OFF. If this setting contradict to your experiment design - please change it.

Best regards,

At 05:44 PM 7/5/2005, you wrote:

Vladimir,
As you suggested, I added the NTD for the D:T 1:6 shots where the yield is expected to be about 4e13. There were some details on the setup that I didn't understand. Would you mind checking those settings? The RIDs are 18541, 18572, and 18573.
I also asked Rich Petrasso to run the CPS1 and CPS2, but again, I don't know the setup parameters.

Thanks,
Steve
--
****
Steven H. Batha
Deputy Group Leader (Acting); P-24, Plasma Physics
Project Leader for Experiments; C4-C10 Program

PO Box 1663 MS E526
Los Alamos National Laboratory

Los Alamos, NM 87545

Courier address: SM-30, Bikini Atoll Road
Los Alamos, NM 87545
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VOICE: (505) 665-5898; FAX: (505) 665-4409; PAGER: (505) 996-1824

Dr. Vladimir Glebov
University of Rochester
Laboratory for Laser Energetics
250 East River Road
Rochester, NY 14623

Phone: 585-275-7454
FAX : 585-275-5960

From: Hans W. Herrmann [herrmann@lanl.gov]
Sent: Monday, May 07, 2007 6:24 PM
To: Vladimir Glebov
Subject: Jun DTRat

Vladimir,

I had promised you a TIM in June, but Beta Mix is now asking for the last 2 TIMs to attempt debris collection. Do you have a high priority diagnostic you were planning in running, or could I offer these TIMs to Gary Grim?

thanks,
Hans

Hans W. Herrmann, Ph.D., CDR (Ret., USNR)
P-24 Plasma Physics, M/S E526
Los Alamos National Laboratory
Los Alamos, NM 87545
herrmann@lanl.gov
505-665-5075
fax: 665-4409

if Foreign correspondence: TSPA or Correspondence

From: Hans W. Herrmann [herrmann@lanl.gov]
Sent: Wednesday, June 13, 2007 2:12 PM
To: vladimir Glebov
Subject: DTRat Shot Day Brief
Attachments: DTRat Jun07 - Shot Day Brief.ppt

Hans W. Herrmann, Ph.D., CDR (USNR)
P-24 Plasma Physics, M/S E526
Los Alamos National Laboratory
Los Alamos, NM 87545
herrmann@lanl.gov
505-665-5075
fax: 665-4409

if Foreign correspondence: TSPA or Correspondence

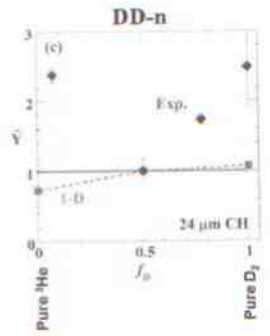
DT Ratio: ^{3}He Addition

PI: Hans Herrmann

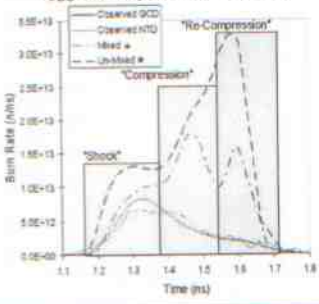
Goals

1. Implosion of DT/^{3}He SiGDP capsules
   - Effects of ^{3}He in DT
     - Anomalously low yields seen when ^{3}He added to D_2
     - **Never done in DT!**
   - Exploration of anomalous Burn History observed with Short Pulse
     - Shock Yield dominant over Compression Yield
     - Likely result of Fall-Line Mix
   - Diagnostic Development
     - GCD/HYNTD(CO_2), NIS & Beta-Mix

2. Implosion of D_2/^{3}He SiGDP capsules
   - Look for D/^{3}He gammas using GCD
     - Determination of D/^{3}He γ/p branching ratio would facilitate determination of DT γ/n branching ratio



Rygg et al. Phys. Plasmas 13, 2006



Shot Plan

D/T/^{3}He Shots:

- SG0604 Laser Pulse (0.6 ns)
- SSD OFF
- Laser Energy = 15 kJ
- Targets depressurized within 45 min of shot
- 10 – 12 Shots (3-5 targets at each pressure)

D_2/^{3}He Shots:

- SG1018 Laser Pulse (1.0 ns)
- SSD OFF
- Laser Energy = 30 kJ
- 2-4 shots

DTRat 13 Jun 07
Shot List

Experiment: DT/3He
Pulse Shape = sg0604
Pulse Width = 0.6 ns
Pulse Energy = 15 kJ
DT Press = 5.0 atm

#	RID #	Shot #	IDC-07-LAN004-Target ID	SiGDP Shell ID (um)	SiGDP Shell Wall (um)	3He Press (atm)	Predicted Yield (1e12)
1	23196		18	1099	4.6	0	6.1
2	23232		12	1112	4.7	1	4.7
3	23233		19	1098	4.7	5	0.98
4	23234		13	1097	4.6	0	6.1
5	23235		14	1100	4.6	1	4.7
6	23236		15	1093	4.6	5	0.98
7	23237		10	1094	4.7	0	6.1
8	23238		3	1097	4.7	1	4.7
9	23239		17	1095	4.6	5	0.98
10	23240		2	1097	4.7	0	6.1
11	23241		11	1100	4.7	1	4.7
12	23242		16	1096	4.6	5	0.98

Experiment: D2/3He
Pulse Shape = sg1018
Pulse Width = 1.0 ns
Pulse Energy = 30 kJ
DD Press = 6.7 atm

#	RID #	Shot #	IDC-07-LAN004-Target ID	SiGDP Shell OD (um)	SiGDP Shell Wall (um)	3He Press (atm)	Predicted n Y (1e11)	Predicted p Y (1e10)
13	23197		3-7	954	4.7	3.3	2.5	2
14	23243		3-3	962	4.7	8.9	1	3
15	23244		3-5	958	4.8	8.9	1	3
16	23245		3-9	949	4.8	8.9	1	3

Diagnostic Layout

- Primary
  - GCD (TIM1)
  - HYNTD/CO_2 – Light Pipe w/ fast PMT
  - NTD
  - ACTR – Copper for DT
  - 12m nTOF
- Secondary
  - XRS (TIM3)
  - NIS (TIM6)
  - HXRD
  - XRPHC's – CID w/ Al, Cu, Fe
  - FABS
  - GMXI
  - KBMICRO 1&3
- Ride Along
  - QXI (TIM2)
  - Beta-mix Debris Collectors (TIM 4&5)
  - Beta-mix Fixed Scintillators

From: Hans W. Herrmann [herrmann@lanl.gov]
Sent: Wednesday, June 13, 2007 2:38 PM
To: vladimir Glebov
Subject: DTRAT Shot Day Brief
Attachments: DTRat Jun07 - Shot Day Brief.ppt

Hans W. Herrmann, Ph.D., CDR (USNR)
P-24 Plasma Physics, M/S E526
Los Alamos National Laboratory
Los Alamos, NM 87545
herrmann@lanl.gov
505-665-5075
fax: 665-4409

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DT Ratio: ^{3}He Addition

PI: Hans Herrmann

Goals

1. Implosion of DT/^{3}He SiGDP capsules
   - Effects of ^{3}He in DT
     - Anomalously low yields seen when ^{3}He added to D_2
     - **Never done in DT!**
   - Exploration of anomalous Burn History observed with Short Pulse
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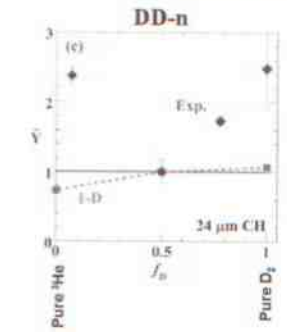
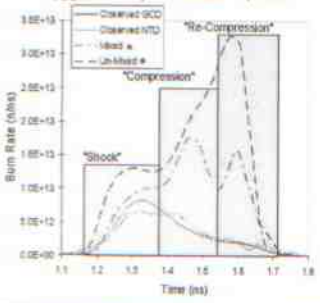


Rygg *et al.* Phys. Plasmas 13, 2006



Shot Plan

D/T/^{3}He Shots:

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- 10 – 12 Shots (3-5 targets at each pressure)

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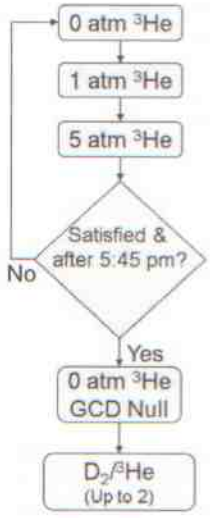

DTRat 13 Jun 07
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From: Hans W. Herrmann [herrmann@lanl.gov]
Sent: Wednesday, July 23, 2008 5:58 PM
To: Vladimir Glebov
Cc: Colin Horsfield
Subject: DTRat

Vladimir,

We were planning to put PTD in TIM-5 on Aug 6, but MIT does not want to use it in DT. So TIM-5 is now available for your use. I tentatively placed CVD Diamond Detector - 1 in TIM-5. You have PI access to the SRF's if you would like to change this. So far, they are RID's 25865 (DT/3He) and 26170 (D2/3He)

We would like to run the light pipe with CO2 and a fast PMT/SCD scope like we did last year. I expect Colin to be interacting with you on this again.

thanks,
Hans

Hans W. Herrmann, Ph.D., CDR (Ret., USNR)
P-24 Plasma Physics, M/S E526
Los Alamos National Laboratory
Los Alamos, NM 87545
herrmann@lanl.gov
505-665-5075
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if Foreign correspondence: TSPA or Correspondence

[X] Unrestricted (P-DIV-POL-020, Att. 1, Rev. 0, 28 March 2006) [ ] - Non-Technical Correspondence [X] - Technical Correspondence LA-UR [ ] - LA-CP [ ] - LALP [ ] Reviewed [ ] ADC - DUSA ADTO [ ] DUSA HEP [ ]

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Thursday, July 24, 2008 7:42 PM
To: Hans W. Herrmann
Cc: Colin Horsfield; Mike Moran
Subject: Re: DTRat

Dear Hans,

Thank you for including me as co-PI and reserving TIM5 for me.
I have edit TIM5 setup for both SRF. You can copy this setup for all future SRF.

I am not sure that the Light Pipe will be available for Colin.
Mike want to use Light Pipe with lead glass instead of CO2 to study neutron Cherenkov signal.
I want to test CO2 maximum sensitivity, i.e. with PMT in the Target Bay just after first mirror.
I don't know that Colin want to do. We will sit all together at LLE before shots and try to find a reasonable compromise in order to satisfy everybody.

Thank you,

Hans W. Herrmann wrote:
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>
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> Hans W. Herrmann, Ph.D., CDR (Ret., USNR)
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> Non-Technical Correspondence [X] - Technical Correspondence LA-UR [ ]
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>
>

--
Dr. Vladimir Glebov
University of Rochester
Laboratory for Laser Energetics
250 East River Road
Rochester, NY 14623

Phone: 585-275-7454
FAX: 585-275-5960

Experimental Proposal Template

I. **Experiment title, principal investigator's name, exact planned shot date, and applicable facility (OMEGA)**

NIC Diagnostic Development (DD), High yield DT shots
V. Glebov, J. Frenje, J.L. Bourgade, M. Moran
31 August 2007

II. **Summary of the experiment's objectives.**

Develop new ICF diagnostics:
Activate and calibrate Magnetic Recoil Spectrometer (MRS)
Calibrate CVD diamond detectors for the NIF
Develop small CVD diamonds for the NIF
Study neutron induced signal in coaxial cables
Study diagnostics vulnerability on OMEGA
Develop Cherenkov Gas Detectors for the NIF

III. **Laser conditions required for the experiment**

- **Pulse shape – SG1018**
- **SSD, DPP, and DPR conditions – PDR, SG4 in all beams, 1 THz SSD**
- **Energy and power/energy balance < 5% in 60 beams**
- **Beamlines used and target pointing requirements – 60 beams to TCC**
- **Backlighting requirements and beam timing delays – none**
- **Special laser conditions, e.g. 2w or 4w probe beam – none**

IV. **Diagnostics required and target chamber port assignments (indicate any non-LLE-provided diagnostics).**

TIM1: LLE CVD diamond (air bubble CVD)
TIM2: LLE CVD diamond (air bubble CVD)
TIM3: LLE CVD diamond (N-type DDRIC)
TIM4: CEA vulnerability tests
TIM5: LLE CVD diamond (N-type DDRIC)
TIM6: LLE CVD diamond (air bubble CVD)
Standard neutronics
MRS, CPS1, CPS2
HYNTD in Target Bay and La Cave
CVD diamond detectors and photodiodes in the Target Bay

V. **A. Type and number of targets including number of spares and a diagram of each type of target** (this section must be completed even if using non-LLE-provided targets). NOTE: if special targets are required, they must be specified more than two months in advance. Additionally, special target geometries may require metrology prior to delivery to LLE and verification after arrival at LLE using LLE's Powell scope.

DT(15)CH[15] – 12

All targets are spheres located at TCC

B. A diagram that displays the beams intercepting the target (VISRAD, vector works, etc.)

All targets are spheres located at TCC

C. Estimated Laser Transmission Through Target:

Significant transmission of laser light through a target can cause damage to the opposed beam optics of the OMEGA compression facility. A beam transmitted through an underdense target can have significant spatial modulation. The potential for such damage is increased when a DPP is used in a beam. To assess the potential for such damage, the PI is required to state the estimated level of laser beam transmission through the target (including blow-through) for the proposed experimental configuration. The basis of this estimate can be a simulation of the laser-target interaction or data from an experiment that closely simulates the proposed experimental configuration. No experiment will be approved unless such an estimate is provided in the template submitted for approval to the OMEGA Scheduling Committee two months prior to the scheduled shot day. Beam dumps or calorimeters can be installed in opposing beams to increase the maximum acceptable energy transmission (for up to six beams). The following matrix shows the maximum allowable blow-through under various scenarios:

DPP in either target or opposing beam?	Beam block (in opposing beam?)	Maximum acceptable energy transmission
Yes	No	20 J
Yes	Yes	200 J
No	No	100 J
No	Yes	300 J

No laser transmission

VI. Number of desired laser shots

10

VII Special shot schedule considerations associated with experiment.

NOTE:

Below is the link to Diagnostics and Pulse Shaping News which will be updated to allow external users to easily find required information.

http://omegawww.lle.rochester.edu/docs/facility/status.html

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Thursday, September 06, 2007 3:52 PM
To: Barbara Hussar
Cc: Johan Frenje; Gary P. Grim; Mike Moran; Mark Wilke
Subject: Re: Request for proposal for Diag Dev, weeks of 29 October and 5 November 07
Attachments: Proposal for November 7.doc

Dear Barbara,

Please find attached experimental proposal for November 7, 2007.

Thank you,

Barbara Hussar wrote:
>>>>>>> *NOTE: Please use this June 2006 updated proposal template
>>>>>>> only.*
>>>>>>>
>>>>>>> *Please forward your PI's experimental proposals for
>>>>>>> October/November 2007 *
>>>>>>>
>>>>>>> As PI, you are responsible for submitting an experimental
>>>>>>> proposal template *two months* in advance of the time the
>>>>>>> experiment is scheduled, coordinating experimental and laser
>>>>>>> requirements, monitoring the actual execution, and writing a
>>>>>>> critique of the execution of the experiment within one week of
>>>>>>> its performance.
>>>>>>>
>>>>>>> The proposal template must be received at least two months prior
>>>>>>> to the conduct of the experiment and will initiate the
>>>>>>> preparation phase for the experiment.
>>>>>>>
>>>>>>> A template form is attached as an MS Word document. Please fill
>>>>>>> this out and return it to Barb Hussar (*bhus@lle.rochester.edu*)
>>>>>>> for distribution to the Omega Scheduling Committee, at least two
>>>>>>> months before your experiment.
>>>>>>>
>>>>>>> If you have any questions, please contact Steve Loucks
>>>>>>> (slou@lle.rochester.edu), John Soures (jsou@lle.rochester.edu)
>>>>>>> (for external users), or David Meyerhofer (ddm@lle.rochester.edu).
>>>>>>>
>>>>>>> Thank you!
>
> *Barbara Hussar
> Administrative Assistant
> Laboratory for Laser Energetics
> Engineering Dept.
> 250 East River Rd.
> Rochester, NY 14623-1299
> Phone: 585-275-8843
> Fax: 585-275-5960
> mailto:bhus@lle.rochester.edu
>
>
> *

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> ---
> --
>
> *Barbara Hussar
> Administrative Assistant
> Laboratory for Laser Energetics
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> 250 East River Rd.
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> Phone: 585-275-8843
> Fax: 585-275-5960
> mailto:bhus@lle.rochester.edu
>
>
> *

--
Dr. Vladimir Glebov
University of Rochester
Laboratory for Laser Energetics
250 East River Road
Rochester, NY 14623

Phone: 585-275-7454
FAX: 585-275-5960

Experimental Proposal Template

I. Experiment title, principal investigator's name, exact planned shot date, and applicable facility (OMEGA)

NIC Diagnostic Development (DD), High yield DT shots
V. Glebov, J. Frenje, G. Grim, M. Wilke, M. Moran
7 November 2007

II. Summary of the experiment's objectives.

Develop new ICF diagnostics:
Activate and calibrate Magnetic Recoil Spectrometer (MRS)
Calibrate CVD diamond detectors for the NIF
Develop Neutron Imaging System for the NIF
Develop small CVD diamonds for the NIF
Develop Cherenkov Gas Detectors for the NIF

III. Laser conditions required for the experiment

- **Pulse shape – SG1018**
- **SSD, DPP, and DPR conditions – PDR, SG4 in all beams, 1 THz SSD**
- **Energy and power/energy balance < 5% in 60 beams**
- **Beamlines used and target pointing requirements – 60 beams to TCC**
- **Backlighting requirements and beam timing delays – none**
- **Special laser conditions, e.g. 2w or 4w probe beam – none**

IV. Diagnostics required and target chamber port assignments (indicate any non-LLE-provided diagnostics).

TIM1: LLE CVD diamond (air bubble CVD)
TIM2: LLE CVD diamond (air bubble CVD)
TIM3: LLE CVD diamond (N-type DDRIC)
TIM4: WRFM with LANL debris collector
TIM5: LLE CVD diamond (N-type DDRIC)
TIM6: NIS pinhole array

Standard neutronics
MRS
HYNTD in Target Bay and La Cave
NIS detector in La Cave
CVD diamond detectors and photodiodes in the Target Bay

V. A. Type and number of targets including number of spares and a diagram of each type of target (this section must be completed even if using non-LLE-provided targets). NOTE: if special targets are required, they must be specified more than two months in advance. Additionally, special target geometries may require metrology prior to delivery to LLE and verification after arrival at LLE using LLE's Powell scope.

DT(15)CH[15] – 18

All targets are spheres located at TCC

B. A diagram that displays the beams intercepting the target (VISRAD, vector works, etc.)

All targets are spheres located at TCC

C. Estimated Laser Transmission Through Target:

Significant transmission of laser light through a target can cause damage to the opposed beam optics of the OMEGA compression facility. A beam transmitted through an underdense target can have significant spatial modulation. The potential for such damage is increased when a DPP is used in a beam. To assess the potential for such damage, the PI is required to state the estimated level of laser beam transmission through the target (including blow-through) for the proposed experimental configuration. The basis of this estimate can be a simulation of the laser-target interaction or data from an experiment that closely simulates the proposed experimental configuration. No experiment will be approved unless such an estimate is provided in the template submitted for approval to the OMEGA Scheduling Committee two months prior to the scheduled shot day. Beam dumps or calorimeters can be installed in opposing beams to increase the maximum acceptable energy transmission (for up to six beams). The following matrix shows the maximum allowable blow-through under various scenarios:

DPP in either target or opposing beam?	Beam block (in opposing beam?)	Maximum acceptable energy transmission
Yes	No	20 J
Yes	Yes	200 J
No	No	100 J
No	Yes	300 J

No laser transmission

VI. Number of desired laser shots

14

VII Special shot schedule considerations associated with experiment.

NOTE:

Below is the link to Diagnostics and Pulse Shaping News which will be updated to allow external users to easily find required information.

http://omegawww.lle.rochester.edu/docs/facility/status.html

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Wednesday, September 13, 2006 1:16 AM
To: Hans W. Herrmann
Cc: jmmack; Colin Horsfield
Subject: Re: Oct 4 Shots

Dear Hans,

Please find attached HYNTD signal from 5 mm BC-422 scintillator and Hamamatsu R3809U-52 PMT (gain 1 E6) recorded today (5 minutes ago) on two channels of 1 GHz TDS 684 scope. Shot 44848 is DT cryo shot with yield 5 E11. Shot 44850 is D2 shot with yield 1.3 E9.

You can see we have a lot of signal from PMT when 100 light go to PMT. I think with ROSS and PMT we have two problems in July. First, light was splitted not 90%/10% but 99%/1% or less, so very low fraction of light reached PMT. Second, we don't know how to collect/focus light on ROSS.

In addition, there are some extra signal after first pulse. We will try to solve all these problems by October. As you can see, HYNTD is not finished diagnostic yet. It need some tunings and adjustments.

Thank you,

At 12:30 PM 9/12/2006, Hans W. Herrmann wrote:

Vladimir,

I agree, NTD will be the main reference diagnostic.

Our primary interest in HYNTD is the CO2 option to provide reference data as we enter into the Gamma Bang Time/Reaction History CDR process. Thus it is probably even more important that we obtain data from it during the high-yield shots for NIS than during the Double Pulse experiment. If CO2 is not ready by Oct, then of course we will have to be satisfied with scintillator data.

I think it would be preferable to run with both streak camera and PMT, although I believe there was some question as to how much actual transmission there was through the splitter to the PMT. We may have a higher gain, 2-stage MCP available if light levels are as low as they were last time, but would prefer to run with the faster single stage. I leave it to you and Joe to hammer this out.

This will be a normal shift, so 14 shots certainly is ambitious. I have agreed to switch over to the NIS shots no later than 4 pm, so I hope to get a minimum of 5 shots for Double Pulse and 5 shots for NIS.

Thanks for the heads up on 30 vs 27kJ.

thank you,
Hans

At 04:15 PM 9/11/2006, Vladimir Glebov wrote:

Dear Hans,

Thank you for information about shots on October 4, 2006.

I think the main reference diagnostic for your Double Pulse experiment will be NTD, not HYNTD. The 5 E12 yield and time separation between pulses match good NTD parameters.

Our plans are to prepare HYNTD in CO2 option by October. This option is not manufactured yet, we will try to finish it by October, but there is no guarantee. What mode (scintillator or CO2) do you have in mind then you refer to Light Pipe?

If CO2 option will be ready we can run HYNTD in CO2 + only PMT (100% light to PMT) mode. This option is similar to GCD1 but in different geometry. Is this what you want?

You experimental plan looks very challenging for me. Is it a normal or extended shift? It is very difficult (practically impossible) to have 8 Double Pulse + 6 high yield shots in a normal 12 hours shift. You can create 14 SRF (just in case), but count on 10 -12 shots. For shots without SSD you should request 30 kJ energy on target (not 27 kJ).

Thank you,

At 05:33 PM 9/11/2006, Hans W. Herrmann wrote:

Vladimir,

As you know, we will be conducting high-yield DT shots on Oct 4. There will essentially be two sets of experiments:

1. We will start off with Double Pulse experiments looking for structure in the reaction history. The expected yield is <=5e12 neutrons using Hoppe shells (~1000 um diameter, 3.8 um glass wall, 10 atm DT). The pulse width will be 0.6 ns (sg0604). The first pulse will contain 10 kJ in 40 beams, followed by a 5 kJ pulse of 20 beams. The delay between the start of the pulses will vary between 0.7-1.0 ns. For diagnostic setup purposes, implosion times range from 1.3 to 1.5 ns. I expect to run 8 of these shots.

2. The second experiment will be high yield for Neutron Imaging. We could get off as many as 6 of these shots (perhaps more if we decide to abandon the Double Pulse experiment after a few shots due to lack of expected results). There will only be 2 Hoppe shells left after the Double Pulse experiment, which we expect to achieve yields of >5e13 neutrons with a 1.0 ns pulse (sg1018) and 27 kJ (i.e. no SSD). The remaining 4 shells are drop towers, which are expected to give somewhat lower yield, but hopefully >2e13.

I understand Joe is coordinating with you on the Light Pipe which I expect to be extremely useful for diagnosing the Double Pulse experiment.

I look forward to my first Omega PI experience on these upcoming shots and would appreciate any advice you might have in making this go smoothly.

thanks,
Hans

Hans W. Herrmann, Ph.D., CDR (USNR)

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Los Alamos National Laboratory
Los Alamos, NM 87545
herrmann@lanl.gov
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Senior Scientists,
Laboratory for Laser Energetics,
University of Rochester,

250 E. River Road,
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Phone 585-275-7454
Fax 585-275-5960

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Rochester, NY 14623-1299

Phone 585-275-7454
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From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Tuesday, December 19, 2006 9:02 PM
To: Hans W. Herrmann
Cc: jmmack; Colin Horsfield; Mike Cruz; Mike Moran; Craig Sangster
Subject: Re: Fwd: Be-quote

Dear Hans,

Before I received this E-mail, I have an impression that LANL has not only license and equipment to machine Be but also stock of Be as a raw material. Other words, like LLE machine shop can make almost any part from Al, I was thinking that LANL machine shop can make easily Be parts.
As usual, reality is more complicated than my impression.

So, if you need to buy beryllium disks from some external company, probably LLE can buy them directly from the same or other company. If such purchase will be impossible for financial/political reasons, then I will use your existing Be disks with 0.56" diameter.

Thank you and have a grate Holiday !

Hans W. Herrmann wrote:
> Vladimir,
>
> We have obtained quotes for the Be converters you requested (see
> below). Unfortunately, we have no budget to purchase them ourselves,
> although that may be an option you may want to consider. All 4
> converters using 98.5% Be would run about $4K.
>
> What we can offer at this time is a somewhat more crude solution. We
> can loan you a number of 2 to 3 mm thick Be discs that we have on-hand
> with a 0.56" diameter. This is shy of the 0.865" diameter you request
> for the 1" section of the Light Pipe, so we would have to fabricate a
> cylindrical sleeve out of aluminum to hold them. This would give you
> the option to stack as many discs as you want to find the optimum
> thickness for Compton production. Alternatively, we could fabricate 2
> dedicated sleeves - one containing 15 mm of Be and the other
> containing 25 mm. Unfortunately, this doesn't give you a converter for
> the 2" section, and it only covers ~40% of the available area of the
> 1" section, but it may tell you if a purchase is worth pursuing.
>
> In the mean time, we will continue to look for other sources of "free"
> Be to see if we can come up with a better solution.
>
> best regards,
> Hans
>
>>> 15mm thick x 0.860" dia.
>>> PF-60 Beryllium(99.0%) $995.00/ea.
>>> PS-200 Beryllium(98.5%) $730.00/ea.
>>> 25mm thick x 0.860" dia.
>>> PF-60 Beryllium(99.0%) $1195.00/ea. PS-200
>>> Beryllium(98.5%) $805.00/ea.
>>> 15mm thick x 1.865" dia. with 1.0" dia. central hole
>>> PF-60 BNeryllium(99.0%) $1800.00/ea. PS-200

>>> Beryllium(98.5%) $1210.00/ea.
>>> 25mm thick x 1.865" dia. with 1.0" dia. central hole
>>> PF-60 Beryllium(99.0%) $1980.00/ea.
>>> PS-200 Beryllium(98.5%) $1320.00/ea.
>>> Delivery:7 weeks after recipt PO Term:Net 30 or creditcard Thanks,
>>> Ted Koo Research Metal Foils, Inc.
>
>
>> Date: Wed, 22 Nov 2006 13:07:00 -0500
>> To: "Hans W. Herrmann" <herrmann@lanl.gov>
>> From: Vladimir Glebov <vgle@lle.rochester.edu>
>> Subject: Re: Be Converter
>> Cc: jmmack@lanl.gov, Colin Horsfield <c.j.horsfield@awe.co.uk>,
>> Mike Cruz <mcru@lle.rochester.edu>, Mike Moran
>> <moran3@llnl.gov>,
>> lerche1@llnl.gov
>>
>> Dear Hans,
>>
>> I will be happy to assist you as a coauthor in your next paper.
>>
>> As far as Be converter, I would like to test converters for both 1"
>> and 2" options.
>> The exact diameter of 1" tube is 0.875" and 2" tube is 1.875".
>> Therefore Be disks diameters should be 0.865" + 0.0 - 0.005" and
>> 1.865" + 0.0 -0.005. I hope this is enough mechanical tolerance and
>> accuracy here.
>> The thickness of Be disks can be 15 mm as in GCD1 or thicker.
>> What is an optimal Be thickness in your Monte Carlo program?
>> Could you make two thickness - one Monte Carlo optimum and another 25
>> mm thick?
>> We can check two thicknesses to benchmark Monte Carlo.
>>
>> Thank you,
>>
>> At 10:56 AM 11/7/2006, Hans W. Herrmann wrote:
>>> Dear Vladimir,
>>>
>>> It was good to see you in Philadelphia last week. I will be writing
>>> up the Bang Time and Double Pulse results over the next few months.
>>> I would greatly appreciate your assistance as a coauthor.
>>>
>>> In the mean time, we would like to see what we can do about
>>> providing you with a Be Compton converter for the Light Pipe. If I'm
>>> not mistaken, you are interested in both a 1" disc and a 2" annulus.
>>> Please send Joe an email request (cc: me) with a set of engineering
>>> drawings (or at least a detailed description of dimensions) and we
>>> will see what we can do.
>>>
>>> thanks,
>>> Hans
>
>
>
>
> Hans W. Herrmann, Ph.D., CDR (USNR)
> P-24 Plasma Physics, M/S E526

> Los Alamos National Laboratory
> Los Alamos, NM 87545
> herrmann@lanl.gov
> 505-665-5075
> fax: 665-4409
>
> if Foreign correspondence: TSPA or Correspondence
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>

--
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FAX: 585-275-5960

From: Hans W. Herrmann [herrmann@lanl.gov]
Sent: Tuesday, February 20, 2007 5:54 PM
To: vgle
Subject: Fwd: Re: Senitivities
Attachments: Detector Sens and Impulse Resp.ppt

Vladimir,
We'll give you a call in 5 min to discuss the attachment.
Hans

Date: Mon, 19 Feb 2007 18:13:45 -0700
To: "Carlton S. Young" <csyoung@qwest.net>
From: "Hans W. Herrmann" <herrmann@lanl.gov>
Subject: Re: Senitivities
Cc: jmmack@lanl.gov

Carl,
Here's a first crack at presenting the Sensitivity & Impulse Response data. It still needs work. We have a lot to talk about.
Hans

At 11:30 PM 2/15/2007, you wrote:

The enclosed spreadsheet has the numbers. The bottom calculation of
required sens is still in progress(Comment?). The calculated
sensitivities should be same as before. The age calculation is
irrelevant to these sensitivities. Have fun.ï¿¼
Carlton S. Young
505 667 2478 or 505 672 9759
or cell 303 204 8570
csyoung@lanl.gov or csyoung@qwest.net
MS D410; Box 1663
Los Alamos National Lab
Los Alamos, NM 87545

This is technical data and software for public access.

The enclosed spreadsheet has the numbers. The bottom calculation of required sens is still in progress(Comment?). The calculated sensitivities should be same as before. The age calculation is irrelevant to these sensitivities. Have fun.

Carlton S. Young

505 667 2478 or 505 672 9759

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This is technical data and software for public access.

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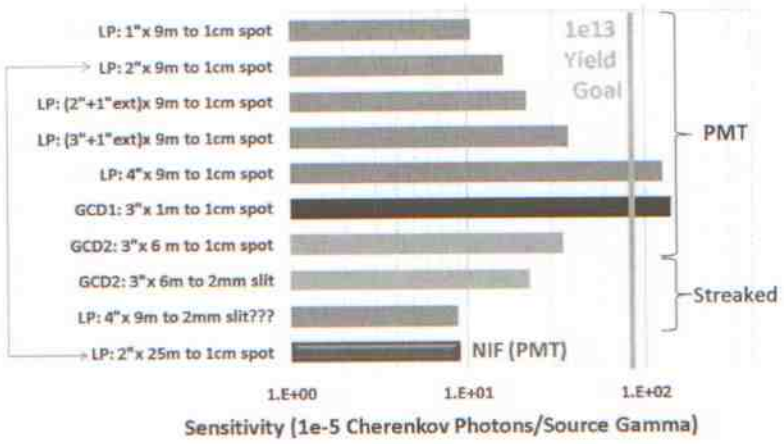
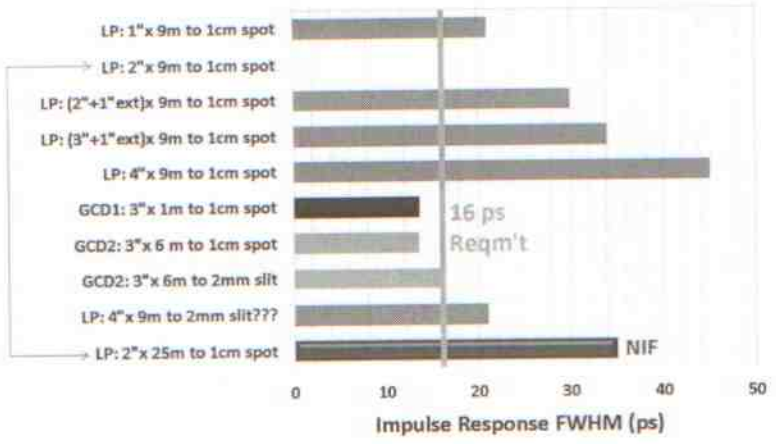
Detector/Transmission Line Sensitivities



- 4" Light Pipe & GCD1 (w/ Omega parameters) can achieve goal of detecting 1e13 NIF neutrons

Detector/Transmission Line Impulse Response



- GCDs may be able to achieve 16 ps requirement on NIF (further analysis needed)

From: Hans W. Herrmann [herrmann@lanl.gov]
Sent: Thursday, February 22, 2007 3:29 PM
To: Louella Gregg
Cc: csan; vgle; tduf; cbarnes; gpgrim; jmmack; vef; dcw; jfrenje; petrasso; li; seguin; dtcasey; rjleepe; reolson; aglitskiy; laurent.disdier; Isabelle.Lantuejoul; michael.houry; Jean-luc.BOURGADE; young2; moran3; celeste1; ng4; kimbrough1; macgowan1; dauffy1; izumi2; lerche1; phillips15; haan1; tommasini2; hammel1; landen1; cbarrera; morse; song6; obrien2; hatchett1; cerjan1; eder1; koch1; kalantar1; atherton1; robey1; pmck; schneider2; fortner1; sacks1; wilke; lindl1; suter1; holder4; gachand; kamperschroer1; datte1; schneider5; holtmeier1; lewis79; watts6; sunke; iversesg; macneilp; Colin Horsfield; hsing1; kauffman2; bonanno1; brereton1; kohut2; sawicki1; throop1; dillman2; gates14; juanc; trb; sreg; mherrma; millerek; oertel; gangitano1; olivier.landoas; bower5; hall9; shepherd1; fittinghoff1; cawilde; sbatha; fulton_robert_d; vernon1; ali1; song6; sharp10; gregg7; Jean Steve; bussey; tromero; trwardl; kariw; mray; dsandra; ejsal; Schaeffe; francoise.wagon; evelyne.dattolo; Drina Cruz
Subject: Re: VTC - 1.5 Ignition Diagnostics - 02/22/07
Attachments: BT-RHD Phys Rev v2.pdf

Importance: High

Today's presentation of the BT/RHD Physics Review is attached.
Hans

ADC: JBW

At 04:03 PM 2/21/2007, Louella Gregg wrote:

>THIS IS A REMINDER
>
>ALL:
>
>The next 1.5 Ignition Diagnostics meeting is scheduled for Thursday,
>February 22 at 8:00 AM (PST). The meeting will be held in B482/R1274.
>Tomorrow's meeting will be devoted to the Physics Review for the
>Bangtime diagnostic with Joe Mack and Hans Hermann making the
>presentation. Agenda is attached.
>
>NOTE: Thank you for being careful to dial in with your correct number.
>
>Video Teleconference Bridging Service Confirmation Lawrence Livermore
>National Laboratory
>
>Title of Conference: I.5 Ignition Diagnostics
>Time of Conference: 8am - 930am Pacific (30min. set-up time)
>
>Participating sites and dial-up numbers are as follows for the
>following dates:
>
>Starting February 22 - June 28, 2007 standing Thursday weekly meeting.
>
>Site(s) / Dial-up Number
>SNLA / 925-423-8814
>LLE / 925-423-8813
>MIT / 925-423-8802
>NRL/ 925-423-8803

>Bechtel Nevada /925-423-8808
>LANL/ 925-423-8809
>CEA/ 925-423-8811
>
>AWE has been added to the I.5 Ignition Diagnostics for 2/22/07. The
>dial in number is:
>
> 925-423-8815
>
> Speed: 384
>
>If you experience any technical difficulties, please dial 925-423-9502
>for assistance.
>
>Thanks,
>
>Louella Gregg
>Lawrence Livermore National Laboratory
>7000 East Avenue, L - 481
>Livermore, CA 94550
>
>Phone: (925) 423-2255
> (925) 423-8804
>Fax: (925) 423-6319
>email: gregg7@llnl.gov
>
>
>

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Gamma Bang Time/Reaction History Diagnostic
NIF Physics Review - Feb 22, 2007

J. M. Mack, H. W. Herrmann, C. S. Young, S. E. Caldwell, S. C. Evans,
T. Sedillo, D.C. Wilson, J. Cooley
Los Alamos National Laboratory, Los Alamos, New Mexico
C. J. Horsfield, D. Drew
Atomic Weapons Establishment, Aldermaston, Reading, Berkshire, U.K.
V. Yu. Glebov, M. Cruz
Laboratory for Laser Energetics, University of Rochester, Rochester, New York
K. Miller, G. Macrum, P. O'Gara, B. Davis, R. Malone
NSTec, Special Technologies Laboratory, Santa Barbara, CA
M. Moran, R. Lerche, R. Griffith
Lawrence Livermore National Laboratory

GBT/RHD Physics Review Outline

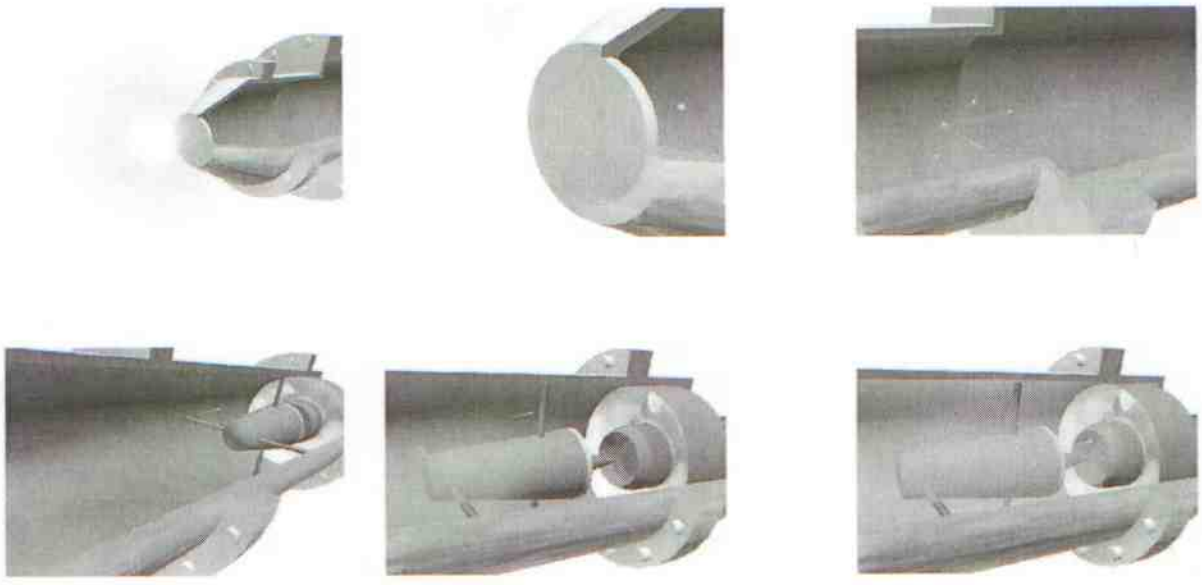
NIF

The National Ignition Facility

I. Intro – Joe Mack
   A. Gas Cherenkov Description
   B. Historical Perspective
II. NIF Requirements – Hans Herrmann
   A. SDR
   B. NIF Baseline Configuration Options
III. Component Analysis
   A. Detector/Transmission Line Modeling – Carl Young
   B. Recording Instruments
      1) PMTs – Colin Horsfield
      2) Digitizers – Kirk Miller
      3) Streak Cameras – future consideration
   C. Additional Issues – Joe Mack
IV. Project Plan – Joe Mack

National Security Technologies LLC AWE Los Alamos NATIONAL LABORATORY UR LLE NF The National Ignition Facility

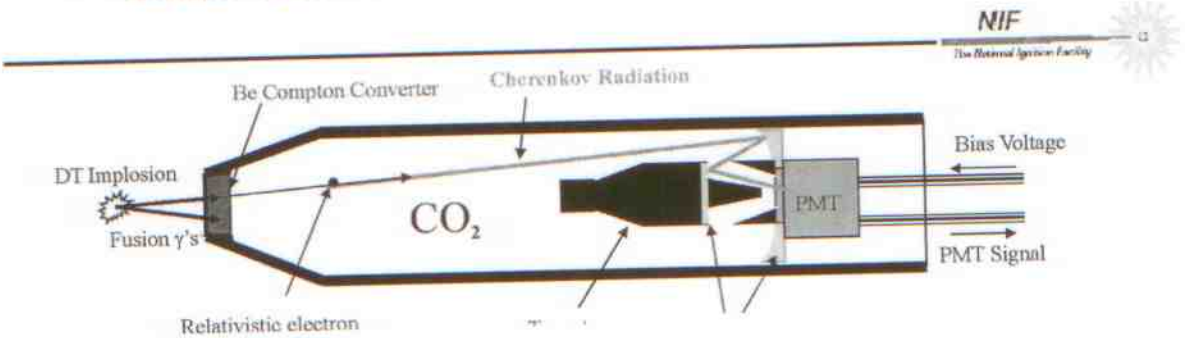
A simplistic transport simulation of the gas Cherenkov detector system



Why a gas Cherenkov detector?

- *Relatively "simple" design*
- *Dramatically improved time resolution*
- *Optical Cherenkov light*
  - *Improved light collection*
- *Energy thresholding flexibility*
- *Time separation of signals*
- *Possible Cherenkov imaging (?)*

Gas Cherenkov Detector (GCD-1)



From: Hans W. Herrmann [herrmann@lanl.gov]
Sent: Thursday, March 29, 2007 11:24 PM
To: Vladimir Glebov
Cc: jmmack
Subject: Re: Fwd: Light Pulsers

Vladimir,

Just a heads-up that we're considering changing shot conditions for June. There has been so much interest in the 600 ps laser pulse results from Oct06 that we may revisit it.

This has also generated a revised interest in the Burn Truncation Studies by McKenty and Stoeckl in 1999. Do you know if anything was ever written up about that work? I haven't been able to find any information other than what you have already provided.

If we go in this direction, the yields will of course be substantially lower than what we were expecting for 1 ns pulses. The predicted yields are 3-18 e12, but may drop even lower due to the anomalous effects on yield of adding 3He as seen by Rygg, et al., in D2.

I've already checked with Mark Wilke to confirm that this will be acceptable for NIS.

On the plus side, the lower yields will allow us to use NTD for comparison with GCD & Light Pipe.

I would like to run Light Pipe in CO2 mode again with one of our high-gain, fast PMTs. We would like to vary the gain on successive shots to extend the gamma-based reaction history coverage range and explore the noise floor of the instrument. We can split the signal again so that we can record on one of your scopes as well as a SCD5000.

I expect at least one TIM to be available for your diagnostic development efforts.

I'll let you know when we make a decision.

thanks,
Hans

At 07:29 AM 3/15/2007, Hans W. Herrmann wrote:
>Vladimir,
>
>We'll be shooting glass GDP shells (OD=1130 um, wall=4.2 um) filled
>with 5 atm DT plus 3He in various quantities (0, 5, 10, 20, 33% by
>atom). Laser pulse will be SG1018 with 23 kJ on target. Expect yield of
>7e13 on the high end (i.e. 0% 3He). I'm waiting on modeling results,
>but might see yield drop an order of magnitude at the highest 3He
>concentration.
>
>Hans
>
>At 07:06 AM 3/15/2007, you wrote:
>>Thank you, Hans.
>>
>>What kind of yields do expect in June?
>>Will they be like in October 2006 in 5 E13 - 1 E14 range or lower?
>>What kind of targets do you planing to use?

>>
>>Thank you,
>>
>>Hans W. Herrmann wrote:
>>>Vladimir,
>>>
>>>You had asked for information on light pulsers at one point.
>>>Here's a table comparing the fast light pulsers which are available
>>>at LANL and NSTec (NLV & SB). We will be borrowing the prototype from
>>>NSTec (SB) to see if it's appropriate for impulse response testing of
>>>our PMTs. If it compares well to results from a sub-ps laser, we may
>>>take it to LLE with us in June. It puts out
>>>3e-14 J in 30 ps.
>>>
>>>Sorry for the delay,
>>>Hans
>>>
>>>_____
>>>Hans W. Herrmann, Ph.D., CDR (Ret., USNR)
>>>P-24 Plasma Physics, M/S E526
>>>Los Alamos National Laboratory
>>>Los Alamos, NM 87545
>>>herrmann@lanl.gov
>>>505-665-5075
>>>fax: 665-4409
>>>
>>>if Foreign correspondence: TSPA or Correspondence
>>
>>
>>--
>>Dr. Vladimir Glebov
>>University of Rochester
>>Laboratory for Laser Energetics
>>250 East River Road
>>Rochester, NY 14623
>>
>>Phone: 585-275-7454
>>FAX: 585-275-5960
>_____
>Hans W. Herrmann, Ph.D., CDR (Ret., USNR)
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505-665-5075
fax: 665-4409

if Foreign correspondence: TSPA or Correspondence

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Wednesday, April 11, 2007 7:11 PM
To: Mario Gangitano
Cc: Mike Moran; Richard Lerche; Joseph M. Mack; Hans W. Herrmann
Subject: Shielding of streak camera
Attachments: HYNTDShieldCDR Minutes.doc; HYNTD_Shield_CDR.ppt

Dear Mario,

Please find attached CDR slides and minutes of streak camera shielding.
You may need something similar on the NIF in case of catastrophic success.

Thank you,

--
Dr. Vladimir Glebov
University of Rochester
Laboratory for Laser Energetics
250 East River Road
Rochester, NY 14623

Phone: 585-275-7454
FAX: 585-275-5960

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Saturday, June 23, 2007 10:54 PM
To: Craig Sangster; Christian Stoeckl; Samuel Roberts; Mike Cruz; Chad Mileham; Mike Moran; Richard Lerche; Lucile Dauffy; Joseph M. Mack; Hans W. Herrmann; Carl Young; Jean-luc BOURGADE; Olivier Landoas; Joël Raimbourg; Chandler, Gordon A.; Miller, Kirk
Subject: Almost final draft of ITER-LMJ-NIF workshop presentation
Attachments: GlebovITER07.pdf

Dear Co-authors,

Please find attached almost final draft of my presentation.
I am very sorry that I am sending it today and not a week ago.
But I was too busy with shots on OMEGA and finished this draft only yesterday.

I will travel on Monday and Tuesday from US to France.
I hope I will be able to read my E-mail on Tuesday evening and make some corrections (if necessary).
Please try to look through slides during Monday or early Tuesday and send you corrections/suggestions before Tuesday noon.

Thank you,

--
Dr. Vladimir Glebov
University of Rochester
Laboratory for Laser Energetics
250 East River Road
Rochester, NY 14623

Phone: 585-275-7454
FAX: 585-275-5960

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Thursday, July 19, 2007 10:04 PM
To: James H. Cooley
Cc: Hans W. Herrmann; Joseph M. Mack
Subject: Re: DPP Abstract

Dear James,

I have one correction and one suggestion to your abstract:

1) Correction:
Could you put period after Yu. in my name V.Yu. Glebov. This second name is from Yuri (my father's name).
In Russian language there is a special single letter for the sound Yu, but in English it is two letters for the same sound.

2) Suggestion:
Your set of authors is good if you plan to use only GCD or GCD and Light Pipe data.
But it will be beneficial for your presentation/paper if you will use NTD data also.
I know that your paper is mainly computational, but you can state in the beginning of the presentation/paper that neutron and fusion gamma reaction histories were measured by 3 different instruments (NTD, GCD, and Gamma Bang Time detector based on Light Pipe) and they all agree with each other.
If you will use NTD data then I recommend to include R.A. Lerche from LLNL who spent a lot of time analysing and comparing NTD and GCD data. I would also recommend to include C. Stoeckl from LLE, who is NTD responsible scientist.
This is your call, but please consult with Hans Herrmann and Joe Mach about authors.
Also what about C.S. Young?

Thank you,

James H. Cooley wrote:
> Co-authors, I plan to submit the following abstract to the APS. If
> you have any suggestions, could you please send them to me by 10:00 am
> (Mountain Time) Friday morning (July 20) so I can incorporate them
> into the final submitted abstract. Please especially check your name
> and initials, but other comments would also be appreciated.
>
>
> JHC
> ADC by DCW
>

--
Dr. Vladimir Glebov
University of Rochester
Laboratory for Laser Energetics
250 East River Road
Rochester, NY 14623

Phone: 585-275-7454
FAX: 585-275-5960

From: Hans W. Herrmann [herrmann@lanl.gov]
Sent: Wednesday, August 29, 2007 12:29 AM
To: Colin Horsfield; Dave Drew; millerek; Vladimir Glebov; Christian Stoeckl
Subject: Bang Time paper
Attachments: Herrmann-GBT v3.doc

Dear external Coauthors,

I've attached a draft of a paper that I plan to submit for the upcoming IFSA conference (September 9-14) covering the gamma bang time measurement improvements we implemented last year, as well as some discussion of NIF ignition requirements.

There's a 4 page limit and I'm guessing it's currently over 5 with all the figures, so it will probably need to be cut considerably. I still need to work on references, figure captions and such, but otherwise it's ready for your review.

Please provide comments by this Friday if at all possible since we've got a long holiday weekend coming up and I need to submit by the middle of next week.

thanks,
Hans

Hans W. Herrmann, Ph.D., CDR (Ret., USNR)
P-24 Plasma Physics, M/S E526
Los Alamos National Laboratory
Los Alamos, NM 87545
herrmann@lanl.gov
505-665-5075
fax: 665-4409

if Foreign correspondence: TSPA or Correspondence

[X] Unrestricted (P-DIV-POL-020, Att. 1, Rev. 0, 28 March 2006) [ ] - Non-Technical Correspondence [X] - Technical Correspondence LA-UR [ ] - LA-CP [ ] - LALP [ ] Reviewed [X] ADC - JBW DUSA ADTO [ ] DUSA HEP [ ]

From: Wolfgang Stoeffl [Stoeffl1@llnl.gov]
Sent: Tuesday, February 05, 2008 9:03 PM
To: Hans W. Herrmann; vladimir Glebov
Cc: Dieter Schneider; dick Fortner
Subject: Mach Zehnder implementation
Attachments: Mach Zehnder implementation.ppt

Dear Hans and Vladimir
I put together a little Powerpoint about the Mach Zehnder
etc. (see attachment)
(Just discussion points, its not a presentation) have a look, and lets discuss it.

The idea about a "fast implementation" is to put a few slightly modified GCD's at the chamber wall at 6 meter, and MZ out of the hall. Heck, that should work just fine. And a bit later, we have the better mirror detectors at the wall, (as planned) useful for Streak cameras. I dont like to put the GCD too close to the Chamber, because we need access to the front of them to implement the calibration features.

I am very weary that the neutron alcove will not be ready... and its not a good place to be background wise, I had a good look at the interference with the TARPOS and other diagnostics at that angle.
Perpendicular would be much nicer. And I hate to have a line-of sight hole into the same room. Lots of trouble...

I am just trying to find out if we can go beside the HEXRI line, about 90 degree to TARPOS. I talked a lot about this with Riccardo, and I have a meeting with their gang tomorrow. There are quite a few holes in the NIF wall which we did not see yet. I will also talk with John Celeste...
Cheers
Wolfgang

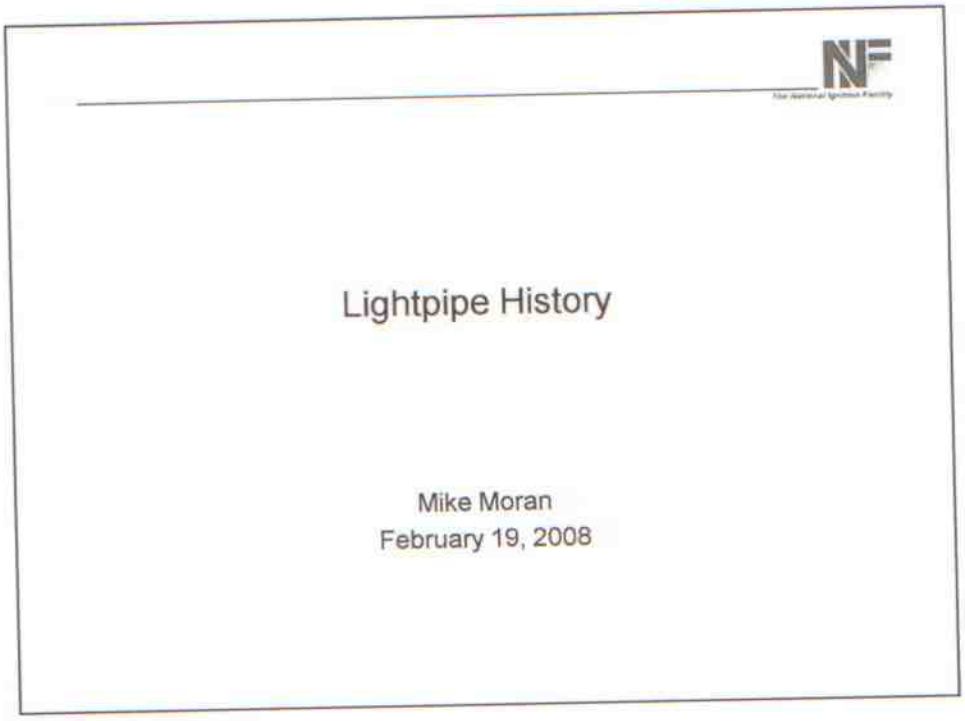
From: Mike Moran [moran3@llnl.gov]
Sent: Thursday, February 28, 2008 11:37 PM
To: DHGSchneider; Stoeffl1; herrmann; vgle; stewart10
Subject: Bangtime thoughts
Attachments: Lightpipe_History.ppt; Lightpipe_KeyResults.ppt

To all,

Please find attached a couple of Powerpoints that I put together.
The first is the material that I showed las week that summarized the sequence of experiments that I have done at LLE with Vladimir Glebov over the past several years. The second presentation selects key results to emphasize their implications on using the lightpipe for measurements such as gamma or neutron bangtime. I also have included old data that I took to characterize the behavior of magnetic spectrometers, CO2 threshold Cherenkov detectors and high-efficiency Cherenkov detectors. Hopefully, this will help to answer some pressing questions and ease the need to repeat a lot of work that already has been done.

Sincerely,

Mike


Lightpipe History
Mike Moran
February 19, 2008

Lightpipe strategy

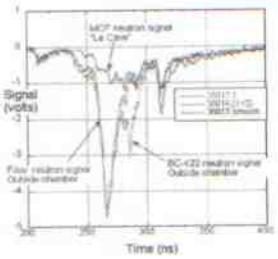
- Driven by NIF challenges
  - Radiation, EMP backgrounds
- Strategy
  - Series of LLE experiments to develop optical signal transmission
  - Ridealong experiments on high-yield DT shots
- Method
  - Optical fiber sensors & transmission, remote detector & recording
    - Conclusion: Backgrounds, dispersion discouraged extensive effort
  - Lightpipe optical link from sensor to remote detector/recorder

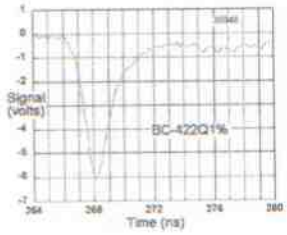
Calendar

- May, 2004: FFD: compare fibers, scintillators
- July, 2004: FFD, BC22, quartz, etc.
- September, 2004: FFD,CO_2, optical link
  - Anticipate lightpipe
- February, 2005: Simple straight lightpipe (1" diam)
- May, 2005: 48 cm/TCC to La Cave (≈ 12 m total)
- July, 2005: 20 cm/TCC scintillators, streaks
- November, 2005: Lightpipe vs CVD and vs. Yn
- July, 2006: Install 2" lightpipe
- May, 2007: Test γ,e^- converters
- August, 2007: Compare W, graphite, lucite γ,e^- conv.

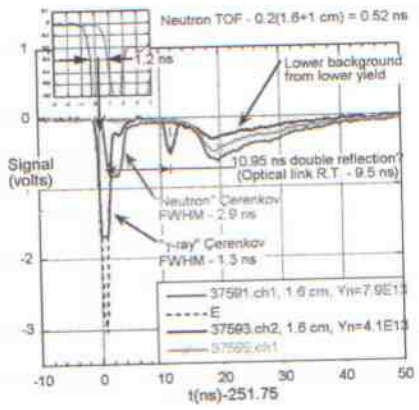
First there was FFD

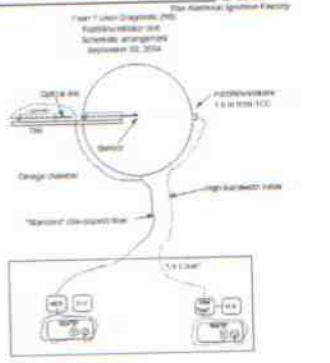
- May, July, 2004
  - Compare fibers, scintillators
  - Fibers sensitive to neutrons
  - Scintillators, glass as detectors
  - Clean BC422Q signals

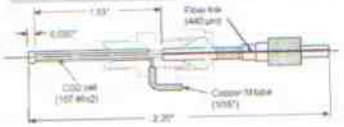




FFD/ CO_2 threshold Çerenkov



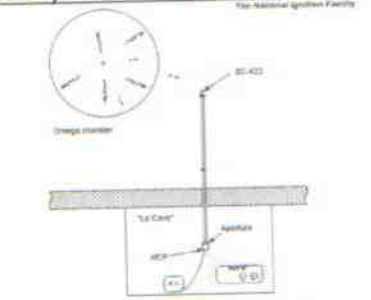


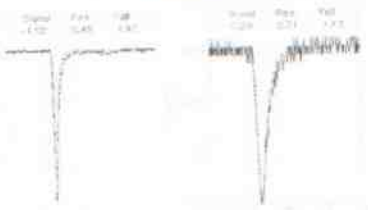


- CO_2 signal is clean
  - Similar amplitude to neutron Cherenkov
  - Timing is correct

Switch to Lightpipe (Feb, 2005)

- Reduce background signals
- More versatile detectors
- Sequence of simple tests
  - Scintillator → glass → CO_2
- Observed expected performance
  - Simple 4-meter straight tube
    - Scintillator @ 4 m from TCC
  - BC-422, MCP, digitizer
  - Fast, clean signal
  - FFDLightpipeinfo

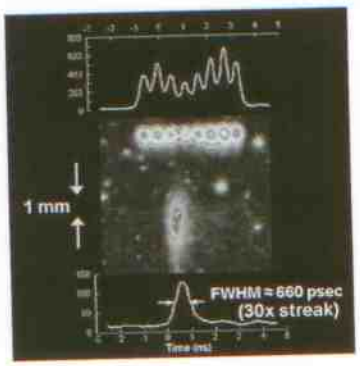


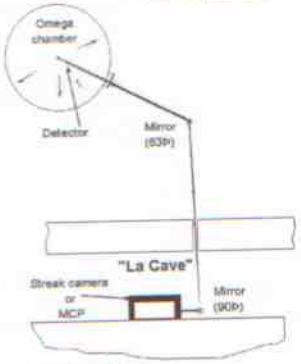


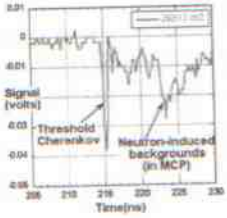
Lightpipe CVD diamond

Lightpipe May, 2005

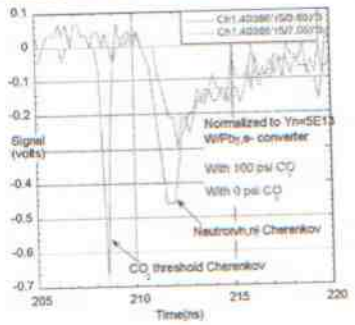
- Reentrant tube to 48 cm from TCC
- Scintillator, neutron Cherenkov, CO_2 TCC
- MCP or streak camera

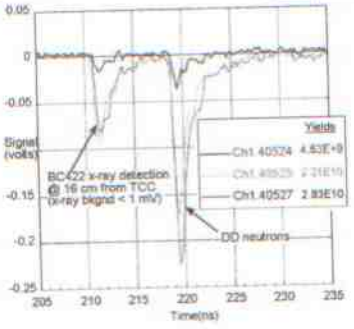






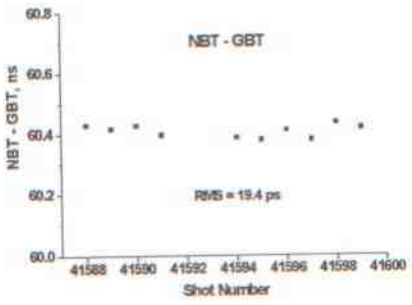
Lightpipe July, 2005

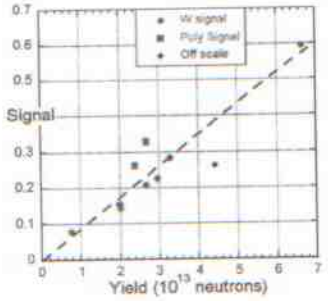




- Sample at 28 cm from TCC
  - Reentrant tube
- MCP and/or streak camera
- γ,e⁻ converter comparisons
  - W, Pb, U238
- BC-422, CO2, SF-6 leaded glass
  - BC-422: DD neuts, DT neuts, x rays
- Demonstrate sensitivity, versatility

Lightpipe November, 2005

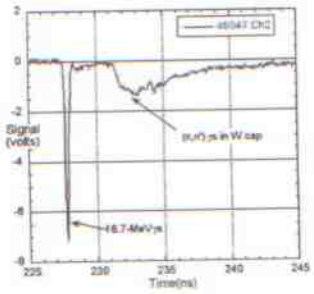


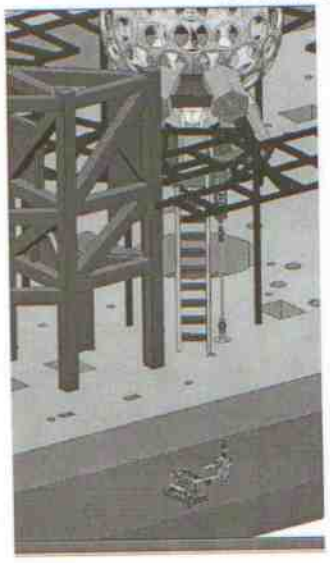


- Study Lightpipe for bangtime timing
  - Compare with CVD bangtime
- Check Lightpipe gamma signal vs. yield.

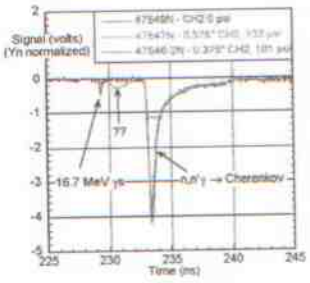
Lightpipe July, 2006

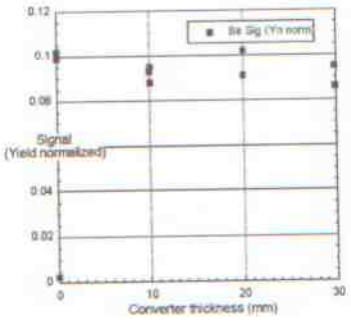
- Switch to 2" tubing
  - Increase transmission
  - easier alignment
  - MCP, streak
  - NIF prototype





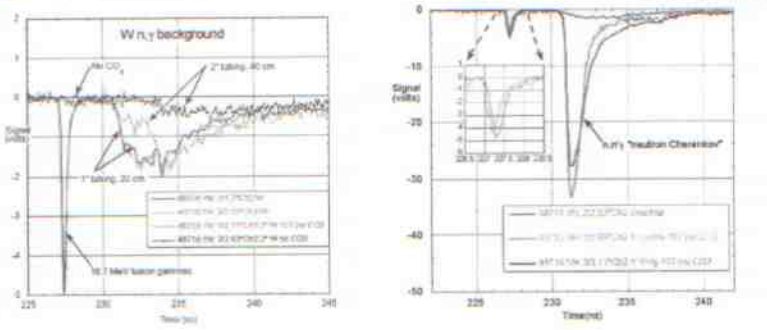
Lightpipe May, 2007





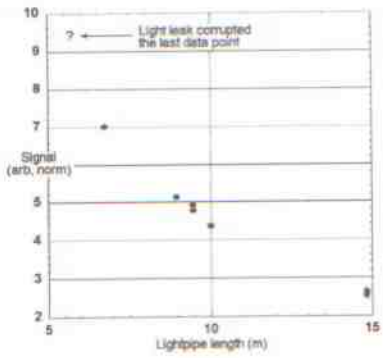
- Test γ,e^- converters
  - Be (vs. thickness), CH_2, graphite, W
- Switch to 2" tubing

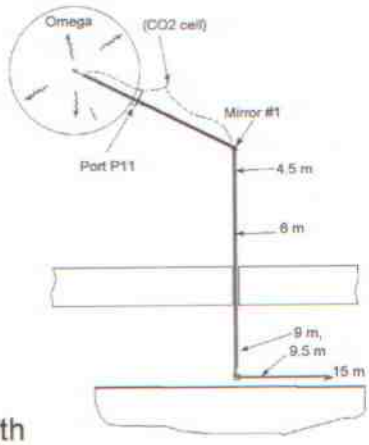
Lightpipe September, 2007



- Compare γ,e^- converters
  - W vs lucite vs poly vs graphite

Lightpipe September, 2007





- Lightpipe: attenuation vs. length
- Result: As length increases, losses moderate

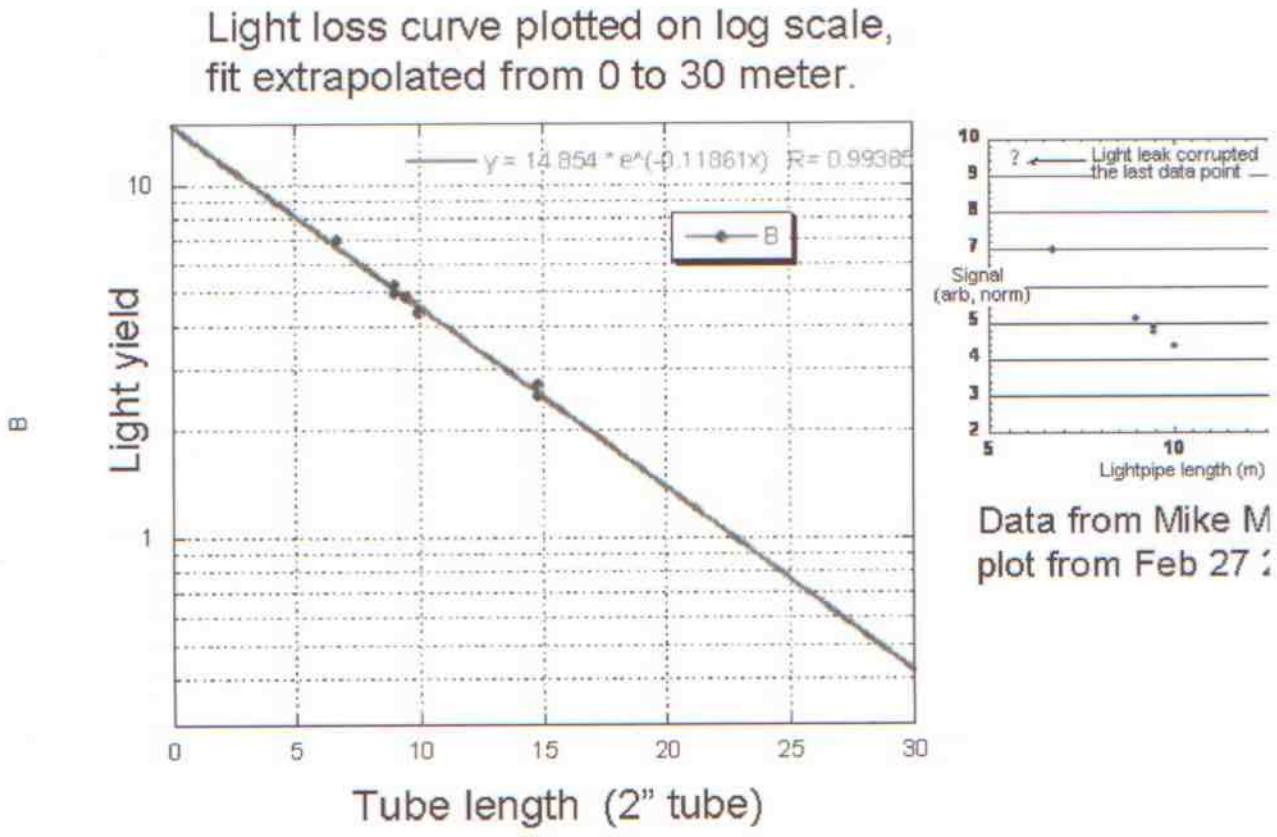
Conclusions

- Lightpipe is viable method for signal transmission at NIF
  - Allows remote signal recording
  - Immune to (external) EMP, radiation backgrounds
- Lightpipe is extremely versatile
  - CO_2 fusion γ bangtime
  - nTOF
    - At chamber port
    - Scintillator or n-Cherenkov
  - Neutron bangtime?
    - Simultaneous with γ bangtime
- Lightpipe is inexpensive
  - Layout, cost estimate exist

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

From: Wolfgang Stoeffl [Stoeffl1@llnl.gov]
Sent: Friday, February 29, 2008 2:29 AM
To: Mike Moran; DHGSchneider; herrmann; vgle; stewart10
Subject: Re: Bangtime thoughts
Attachments: 16433fc0.jpg; Light pipe transmission.ppt

Dear friends
Very nice work, Mike.
I make a few interesting observations from the presented data. The neutron "Cherenkov" bump is most likely due to Cherenkov light produced in the pressure window, its very efficient if its in the wrong location. Or it is the scintillation I mentioned, stainless does scintillate, CO2 also, but at a very low level. The typical scintillation decay constant is a few ns. So it makes sense.
The light loss along the tube is quite interesting, I plotted the data again in a log plot, and then its a nice exponential decay with distance, as expected. And it shows that for a thin light pipe, the reflection loss is quite severe, too severe for the NIF 25-30 meter. It is actually interesting to observe that putting the same Cherenkov detector at a distance of 10 meter or 30 meter will not make any difference in the collected light, the pipe loss is the same as the r^2 loss. A large diameter light pipe would definitely reduce the transmission loss. A 4" pipe will have the same loss at 30 meter as a 2" pipe at 15 meters. The data also show that the pressure window can not be in the line-of-sight, so an initial double mirror system is needed anyway, to get the window into a shielded area, and at 90 degree to the prevailing gamma wind.
Cheers
Wolfgang



At 03:36 PM 2/28/2008, Mike Moran wrote:

To all,

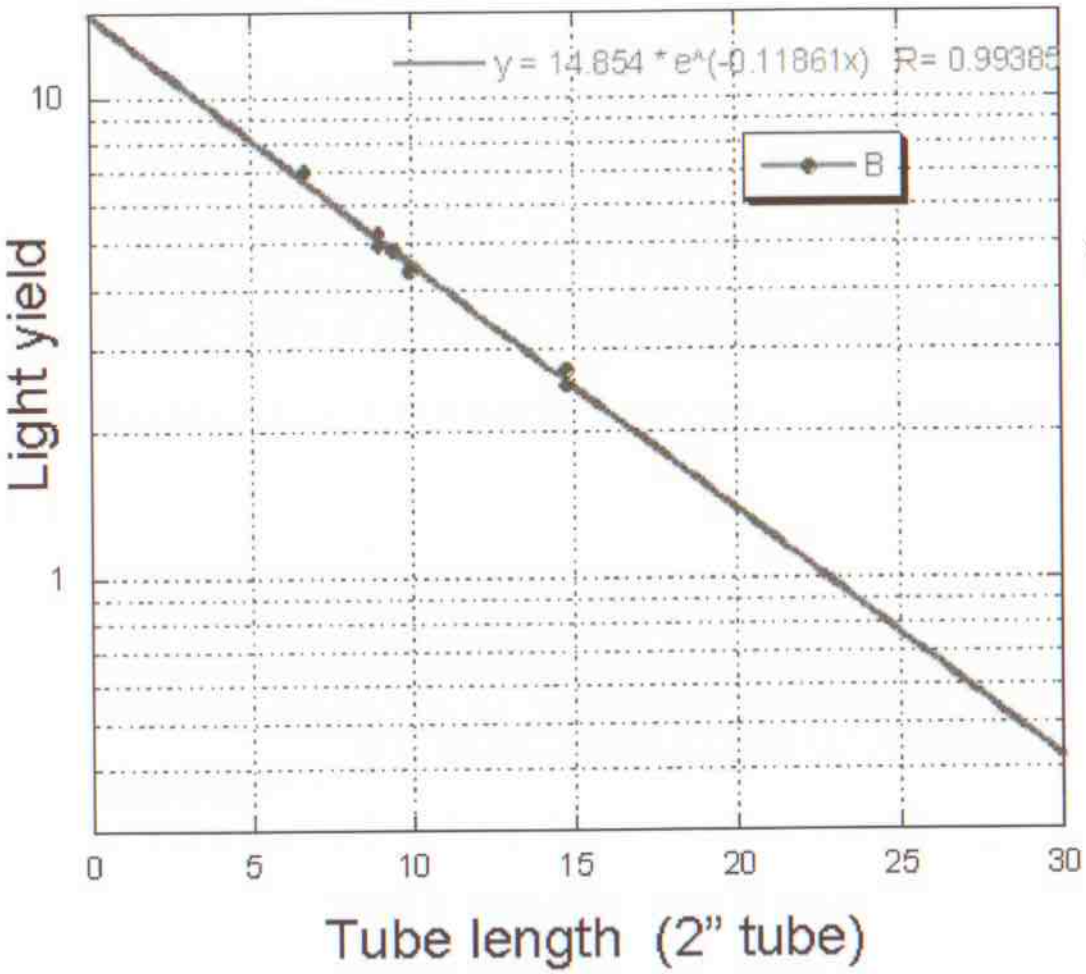
Please find attached a couple of Powerpoints that I put together. The first is the material that I showed las week that summarized the sequence of experiments that I have done at LLE with Vladimir Glebov over the past several years. The second presentation selects key results to emphasize their implications on using the lightpipe for measurements such as gamma or neutron bangtime. I also have included old data that I took to characterize the behavior of magnetic spectrometers, CO2 threshold Cherenkov detectors and high-efficiency Cherenkov detectors. Hopefully, this will help to answer some pressing questions and ease the need to repeat a lot of work that already has been done.

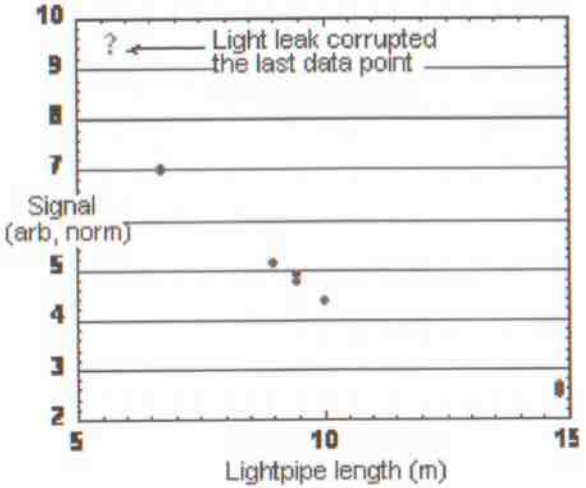
Sincerely,

Mike

B

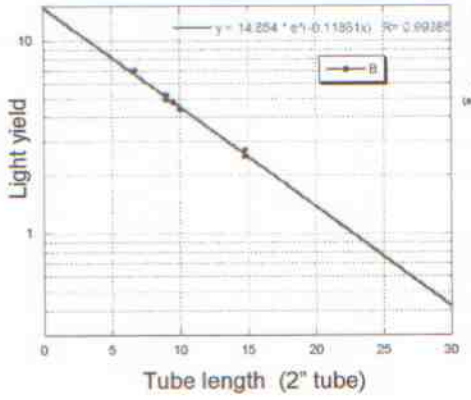
Light loss curve plotted on log scale, fit extrapolated from 0 to 30 meter.

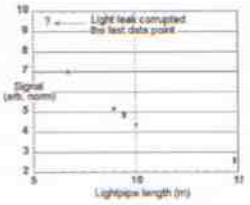




Data from Mike Moran's plot from Feb 27 2008

Light loss curve plotted on log scale,
fit extrapolated from 0 to 30 meter.





Data from Mike Moran's
plot from Feb 27 2008

From: Hans W. Herrmann [herrmann@lanl.gov]
Sent: Friday, May 23, 2008 7:06 PM
To: jmmack; c.j.horsfield; csyoung; csyoung; herrmann; evans_s; sedillot; sanchezp; scaldwell; caldwellsf; jrl; Wolfgang Stoeffl; MILLEREK; Tunnell, Thomas; Bob Malone; Kaufman, Morris; Frogget, Brent; Dave.Drew; Zaheer Ali; Frayer, Daniel; George Idzorek
Cc: Steve Batha; vladimir Glebov; James Knauer; Douglas C. Wilson
Subject: GCD Results for May 21-22, 2008

Dear Reaction History Team,

We fielded LANL's GCD-1 as a ride along on Vladimir Glebov's high-yield diagnostic-development shot days, May 21,22. Although we were plagued by high voltage trip problems on the PMTs, we were still able to obtain data on 7 of 24 shots.

The good news is that we were able to field aluminum and gold secondary targets, to act as simulated hohlraums, and use the GCD and light pipe to look for neutron-induced secondary gammas. This experiment was motivated by the fact that the nuclear cross sections that go into MCNP calculations are quite uncertain at 14 MeV neutron energy. This was an attempt to determine whether there would be any unexpected secondary gammas from the indirectly-driven hohlraums at NIF that would interfere with our fusion gamma measurement. This typically isn't a concern at Omega since all their implosions are direct-drive, hence the need for simulated hohlraums. Preliminary analysis indicates that there were no surprises.This is a positive indication that secondary-gammas from the NIF hohlraum should not interfere with the fusion gamma and capsule gamma (e.g., C-12(n,g)) signals any worse than expected.

Unfortunately, we were unable to isolate the source of the high voltage trips due to its intermittent nature and the possibility of multiple failures. We replaced every single component (HV power supply, 3 SHV cables, 2 SHV bulkhead feedthroughs, 1 PMT) and still had trips. There appeared to be a correlation with TIM pressure (more trips when the TIM was pumped down) but even that wasn't absolute. We clearly had issues with the first PMT we fielded (PMT 110-804) since it caused trips of the HV power supply even when it was plugged directly into the power supply down in La Cave. It's not clear if this tube was damaged from the outset, or if the trips caused the damage. The other single-stage tube (PMT 110-513), however, appeared to be rock solid when plugged in directly (both before and after the experiments), but yet the still had trips when inserted into the GCD.
All 3 or our Photek PMT's were recently potted and repackaged back at Photek, but this seems unlikely to have been the cause of our problems. Interestingly, the power supply was tripping on "high voltage" rather than "high current" indicating that it was unlikely to have been an intermittent short. We plan to replicate the configuration in the Trident TIM once the GCD is decontaminated and shipped back to LANL (~1 week) so that we can identify the issue before coming back to Omega.

Fortunately, we have another opportunity to complete our experimental plan during a recently-announced, high-yield shot day coming up on Thurs, June 19. Vladimir has invited us to field GCD-1 in TIM-1 again. This should give us the baseline data needed to extract a DT branching ratio after the absolute calibration validation is completed at Duke. It looks like Colin will not be able to join us, but Dave Drew will be available to run AWE's Lab View control and data acquisition software.

This means however that the GCD will be tritium contaminated and will not be available for use at Duke on the 23rd. I spoke to Jack Armstrong and learned that the best case scenario for getting it released after a Thurs shot day is Tues morning the following week, and that's assuming it gets decon'ed on Friday and swipes clean on Monday. There's even a slight risk in

assuming that we could get it to Duke in time for a one-week delayed shot day (i.e., June 30). To be safe, I think we should be looking at the week of July 7 if at all possible.

Hans

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if Foreign correspondence: TSPA or Correspondence

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Friday, May 30, 2008 1:32 PM
To: John Soures
Cc: slou; ssta; smor; pien; csan; ddm; dmay; pmck; thorp; jkel; mbon; dhar; mbarry; jste; Hans W. Herrmann
Subject: Re: DD- 6/19/08
Attachments: June 19, 2008 shot plan.xls

Dear John,

Please find attached a corrected shot plan for June19, 2008 diagnostic development day.
SRF 25768 has all correct configuration.

Thank you,

John Soures wrote:
> In reviewing the 16 June 2008 shot week, the OMEGA Scheduling
> Committee noted that you specify the CEA NIS in TIM6 for your DD shots
> of 6/19/08. Please note that this configuration is incompatible with
> the week's other experiments. Please resubmit your SRF's with the
> correct configuration - No NIS in TIM6.
>
> John M. Soures
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--
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From: Wolfgang Stoeffl [Stoeffl1@llnl.gov]
Sent: Friday, May 30, 2008 6:44 PM
To: John Celeste; Dieter Schneider; Dick Fortner; Charlie Cerjan; Steve Haan; Rich Zacharias; Andrew Mackinnon; Steve Hatchett; Rick Stewart; Richard Lerche; Jeff Koch; Joseph Mack; Mark Bowers; Dan Kalantar; Brian K. Spears; Craig Sangster; Steven Batha; Doug Wilson; Jeff Atherton; Hans Herrmann; Vladimir Glebov; Lucile Dauffy; Kirk Miller; Mark Lowry; Corey Bennett; Riccardo Tommasini; Bob Malone; Colin Horfield; Carlton Young; sedillot; sanchezp; scaldwell; jrl; Ali Zaheer
Subject: Fwd: LANL Workshop Report March 2008
Attachments: NIF Nuclear diagnostics reviewer report Third draft.doc

Dear Friends
Attached is the LANL NIF nuclear diagnostics workshop report sent by James Knauer (LLE) to Ed Moses.
Cheers, and lets move forward.
Wolfgang Stoeffl

>X-Sender: jkna@mail.lle.rochester.edu
>X-Mailer: QUALCOMM Windows Eudora Version 6.1.2.0
>Date: Fri, 30 May 2008 11:02:10 -0400
>To: ugreife@mines.edu, moody3@llnl.gov, moran3@llnl.gov, stoeffl1@llnl.gov
>From: James Knauer <jkna@lle.rochester.edu>
>Subject: Workshop Report
>
>Dear Session Chairs,
> I have attached a copy of the report from the NIF Nuclear
> diagnostic workshop held at LLNL. This document was submitted to
> E. Moses on May 11, 2008. You may feel free to distribute to your
> session participants. Thank you for your help in assembling the
> information in this report.
>
>Regards,
>Jim Knauer
>
>
>James P. Knauer
>Senior Scientist
>Laboratory for Laser Energetics
>University of Rochester
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>jkna@lle.rochester.edu

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Tuesday, June 24, 2008 1:55 PM
To: Hans W. Herrmann
Subject: Re: GCD Results for Jun08
Attachments: Results_06_19_2008.ppt

Dear Hans,

I am glad that you have found source and fixed GCD problem.
I am attaching my slides that I presented yesterday.

Thank you,

Hans W. Herrmann wrote:
> Vladimir,
>
> We've figured out what went wrong with the GCD last week. Turns out
> the bias voltage to the PMT was considerably lower than what we
> thought it was.
>
> In an effort to avoid the high voltage trips we experienced in May, we
> implemented a low-pass filter on the high voltage line. This filter
> used 1 MOhm filter resistor in series with the PMT which resulted in a
> 400 V drop in the bias voltage. Unfortunately, we were monitoring the
> voltage at the output of the power supply, upstream of this resistor,
> and tricked ourselves into believing that the bias was adequate. It
> was a poorly designed filter and I should have thought to pull it from
> the circuit when we started having problems. A lower bias voltage is
> consistent with the observations from last week.
>
> On the positive side, we've conclusively determined what caused the
> problem and are confident that the GCD will operate satisfactorily in
> the future.
>
> Hans
>
>
> _____
> Hans W. Herrmann, Ph.D., CDR (Ret., USNR)
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> [X] Unrestricted (P-DIV-POL-020, Att. 1, Rev. 0, 28 March 2006) [ ] -
> Non-Technical Correspondence [X] - Technical Correspondence LA-UR [ ]
> - LA-CP [ ] - LALP [ ] Reviewed [ ] ADC - DUSA ADTO [ ] DUSA HEP [ ]
>

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--
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From: Hans W. Herrmann [herrmann@lanl.gov]
Sent: Monday, July 28, 2008 12:41 AM
To: vladimir Glebov; wilke
Subject: SRF Setups
Attachments: DTRat'08 Shot List.xls

Vladimir & Mark,

I've attached the Shot List for DTRat'08 coming up on Aug 6. DD-RIC & NIS are listed as Ride Alongs on the SRFs. I would appreciate it if you could up date the setup sheets for these diagnostics by COB on Monday.

Vladimir- I've also tentatively included HYNTD as a primary diagnostic for the DT/3He shots (CO2 mode) and secondary for D2/3He shots (Scintillator). We can discuss next week.

thanks,
Hans

Hans W. Herrmann, Ph.D., CDR (Ret., USNR)
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[X] Unrestricted (P-DIV-POL-020, Att. 1, Rev. 0, 28 March 2006) [ ] - Non-Technical Correspondence [X] - Technical Correspondence LA-UR [ ] - LA-CP [ ] - LALP [ ] Reviewed [ ] ADC - DUSA ADTO [ ] DUSA HEP [ ]

Shot List, Aug 6, 2008 - DT Ratio: Hydro-equivalent 3He Addition

Experiment: DT/3He
Pulse Shape = sg0604
Pulse Width = 0.6 ns
Pulse Energy = **16.3 kJ**

#	RID #	Shot #	Target	3He Conc (at.%)	Total Press (atm)	Atomic Ratios D:T:3He	IDC LANL 08-4 DTRat-08A Target ID
1	25865		A1	0	9.11	13.3:5:0	17
2	26198		B1	10	9.55	10.7:5:1.7	19
3	26199		C1	35.9	10.50	5:5:5.6	22
4	26200		A2	0	9.11	13.3:5:0	14
5	26201		B2	10	9.55	10.7:5:1.7	21
6	26202		C2	35.9	10.50	5:5:5.6	5
7	26203		A3	0	9.11	13.3:5:0	13
8	26204		B3	10	9.55	10.7:5:1.7	15
9	26205		C3	35.9	10.50	5:5:5.6	12
10	26206		A4	0	9.11	13.3:5:0	7
11	26207		B4	10	9.55	10.7:5:1.7	18
12	26208		C4	35.9	10.50	5:5:5.6	9

Experiment: D2/3He
Pulse Shape = sg1018
Pulse Width = 1.0 ns
Pulse Energy = 30 kJ
DD Press = 6.7 atm
3He Press = 13.4 atm

#	RID #	Shot #	Target	3He Conc (at.%)	Total Press (atm)	IDC LANL 08-4 DTRat-08A Target ID
13	26170		D1	50	20.1	?
14	26209		D2	50	20.1	?
15	26210		D3	50	20.1	?
16	26211		D4	50	20.1	?

SiGDP Shell		Predicted DT-n Yield	Proton Diagnostics	
			WRFM dist-to-TCC	CPS Slit Width
ID (um)	Wall (um)	(1e12)	(cm)	(mm)
1098	4.85	7	30	2
1106	4.85	5	75	2
1086	4.84	1.5	75	2
1100	4.86	7	30	2
1086	4.87	5	75	2
1095	4.87	1.5	75	2
1078	4.92	7	30	2
1079	4.88	5	75	2
1097	4.89	1.5	75	2
1087	4.90	7	30	2
1097	4.90	5	75	2
1105	4.91	1.5	75	2

SiGDP Shell		Predicted DD-n Yield	Predicted D3He-p Yield	WRFM dist-to-TCC	CPS Slit Width
ID (um)	Wall (um)	(1e11)	(1e10)	(cm)	(mm)
1090	4.9	1	2	75	1
1090	4.9	1	2	75	1
1090	4.9	1	2	75	1
1090	4.9	1	2	75	1

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Monday, August 07, 2006 9:09 PM
To: Scott Evans
Cc: c.j.horsfield; caldwellsf; cchristensen; csyoung; csyoung; gautier; jmmack; jrl; kingr; scaldwell; sedillot; lerche1
Subject: Re: November 3rd shots for GCD-1

Dear Scott,

If GCD group thinks that a shorter signal cable is important for GCD1 measurements, TIM-3 can be reserved for GCD1.

I want GCD1 to participate in November 3 shots in order to measure time resolution of GCD1 and Light Pipe. I invited LANL to participate in November 3 shots, but so far only Gary Grim confirmed his participation.

1) Does your E-mail means that GCD1 will for sure participate in November shots?
Is this official? Or is GCD1 participation in November still a question of LANL budget, politics, etc. ?

2) What about GCD2 ?
Do LANL want to continue with GCD2? If yes, in what configuration: streak camera or PMT?
In November Tektronix 6604 scope will be used for Light Pipe. Therefore GCD2 in PMT version will need it own scope.

I need LANL decision about GCD1 and CGD2 in November ASAP because I need to prepare cables, fiducial, and scopes for CVD diamonds and Light Pipe.
For example, if GCD2 will not run in November, I will put CVD diamond detector in TIM-5. If GCD2 will run, I will put CVD diamond in different TIM and will need a different cable.
Also optical fiducial - how many we will need and in what location depends on GCD1 and GCD2 participation.

Best regards,

At 06:03 PM 9/19/2005, Scott Evans wrote:

Hi Vladimir, We would like to request to use TIM-3 for the November Omega experiments using GCD-1. We would like to use a shorter signal cable to increase the bandwidth.
Thanks,
Scott
--
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(505)699-1581 (Cell)
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From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Monday, August 07, 2006 9:12 PM
To: jmmack; Colin Horsfield
Subject: GCD1 and HYNBT comparison

Dear Joe and Colin,

This is a first, very preliminary comparison of GCD1 and HYNBT.

1) About HYNBT
I now have a program that calculate bang time for a middle channel (the same channel that was used for Light Pipe in November). But it not absolutely calibrated yet. It is correct only on shot to shot basis. I will calibrate it by the end of the week. So, HYNBT bang time may shift by 200 - 500 ps.

2) GCD1 to HYNBT comparison
Look into spreadsheet. I took Colin's data and add some arbitrary number to make GCD1 bang time close to HYNBT.

For one shot - 40365 there is a big difference between GCD1 and HYNBT.
This may be CVD diamond effect in HYNBT. I noticed that CVD diamond require some time after turning HV source ON. Since shot 40365 was a first shot of the day it may be HYNBT measure it incorrectly. This is a reason why I deleted this shot from a plot.

I weed to work more on this comparison.
But I this is enough for tomorrow VTC.

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From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Monday, August 07, 2006 9:12 PM
To: Brian MacGowan; Bruce Young; Mike Moran; haan1; hatchett1; lerche1; jmmack; Colin Horsfield; csyoung; caldwellsf; cchristensen; petrasso; li; Laurent.disdier; Jean-luc.bourgade
Cc: csan; csor; csto
Subject: Gamma Bang Time detector based on Light Pipe

Dear Colleagues,

In preparation for Gamma Bang Time (GBT) detector discussion next week in I.5 Ignition Diagnostic VTC I am sending to you some slides and data in advance. The idea is that you can look on data and plots in advance and be more prepared for discussion.

If you are interesting only in summary, see file RESULTS_11_03_2005.ppt.

If you are not familiar with Light Pipe, see Mike Moran's presentation ICOPS_2005_Moran.pdf

If you are interesting in details, see .ps and .txt files

Shot description of the experiment:

1) Setup
Light Pipe with CO2 cell was assembled on sub-port P11D with 2" reentrant tube at 16 cm from TCC. One inch CO2 cell has length 163.1 cm with 3 mm tungsten cap on one end (to target) and quartz window on other end. One inch polished stainless steel pipe (Light Pipe) with one mirror relay light from CO2 cell to PMT in La Cave. One lens in the end of Light Pipe focus light to PMT photo cathode. In November we use Hamamatsu R3809U-52 PMT with 11 mm photo cathode and gain 1 E4. Tektronix 6604 scope (6GHz, 20GS) was used for recording signal from PMT. Originally I plan to use Gas Cherenkov Detector 1 (GCD1) as a reference point, but when GCD1 was unavailable, used High Yield Neutron Bang Time (HYNBT) detector instead. The second channel (5mm x0.25 mm CVD diamond) of HYNBT detector was connected to first scope channel and used as timing reference to bang time. Signal from NBT detector was attenuated near scope by 20 dB (10 times). So signal on a scope was 2 - 4 V, but 20 -40 V from detector. Light Pipe signal was without any attenuation.

2) Shot sequence
All shots with the exception shots 41589 and 41590 were recorded with a "standard" radiator of 3 mm tungsten. For shots 41589 and 41590 a 0.375" thick CH disk was added after tungsten cap. Pressure cell was removed and reinstalled two times during the day: after shot 41588 and 41590.

3) CH effect
CH disk increase gamma signal by 30 - 40% but simultaneously increased neutron signal more than 10 times. Explanation of this effect is not yet clear.

4) Time difference
Time difference between NBT and GBT (Light Pipe) signals was calculated with a simple modification of nTOF program (see .ps files). This is probably not the best program for such kind of analysis but it gives about 20 ps RMS. Everybody welcome to do his or her own analysis of time difference.

5) Yield
Gamma peak sum is approximately linear to neutron yield. Maybe we have some fraction of X-ray signal inside

gamma signal at low yields. This is similar to GCD2 results in May 2005. Not enough low yield data to study X-ray fraction in detail.

6) Light leak
We have a small light leak (probably in connection near target bay floor) in November. This light leak produce one or two small peaks between 145 and 150 ns. For shots with SSD ON (shots 41593 and 41597) amount of unconverted light in the Target Bay is larger and light leak peaks are larger.
This small light leak has no effect on fusion gamma data.

7) Repeatability and Alignment
Between July and November Light Pipe was completely disassembled including removing reentrant tube from the Target Chamber. In November reentrant tube and Light Pipe was reinstalled on Omega. We use in November different PMT, different scope and cables. But if you compare shot 40351 from July with November data you can see very similar scope trace with the same gamma and neutron peaks.

Light Pipe was aligned with laser pointer on 10/31/2005. It was used with scintillator on 11/02/2005 and with CO2 cell 11/03/2005 without any re-alignment. During November CO2 cell was taken out, filled with gas and reinstalled 4 times including two times during measurements between shots. All within 20 ps time difference.

First I was surprised by such robustness, but later I understood that Gamma Bang Time is insensitive to position shift and alignment imperfection. Since everything is moving with speed of light or faster (fusion gammas, electrons, Cherenkov light) even if CO2 cell will be shifted by 5 mm in radial direction it will have a very little effect on gamma signal timing. The same in transversal direction, because change in a light path will be small. Since Gamma Bang Time detector is not imaging, but just collecting light to relatively large photo cathode (11 mm), shift of a focal point by several mm has very small or no effect.

This feature is a big advantage of Gamma Bang Time detector in comparison with Neutron Bang Time detector where every shift by 1 mm in distance correspond 20 ps shift in timing.

I don't understand why alignment stability considered the most severity (1) technical risk in RMP for Gamma Bangtime. We should discuss this on VTC.

In conclusion:
We have a very good set of data that demonstrate proof of principal of Gamma Bang Time Detector based on Light Pipe.

Thank you,

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From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Tuesday, November 21, 2006 9:01 PM
To: Joseph M. Mack; Hans W. Herrmann; Mike Moran; lerche1; Craig Sangster; Mike Cruz; csto; Colin Horsfield
Subject: Gamma Bang Time and hard X-rays sequel

Dear Colleagues,

On September 25, 2006 I have sent you a first E-mail with subject "Gamma Bang Time and hard X-rays". In that mail I showed that 3 mm tungsten cap is a good shielding for direct drive hard X-rays, but not enough to protect Light Pipe (or any Gamma Bang Time detector) from indirect drive hard X-rays. The September data were recorded with scintillator. The remaining question was about interaction of X-rays in CO2 cell. I promise to check CO2 signal in indirect drive shots at first opportunity.

Such opportunity was last Friday in indirect drive Sandia shots. The HYNTD was re-assembled in CO2 mode with pressure 100 psi, 3 mm tungsten cap at 23 cm from TCC and all light directed to PMT with gain 1 E6. So, it was exactly the same configuration as in October 2006 double pulse experiment except that different PMT with gain 2.6 E5 was used in October and signal from PMT was split between two different scopes and was split into two scope channels in HYNTDPMT scope. Last Friday all signal was recorded in one scope channel and fiducial on the second channel.

I am sending to you just two shots with the highest level of hard X-ray signal.
Shot 45548 has a 3/4 hohlraum with 213 pC signal in the forth HXRD channel (>80 keV) and shot 45549 has a 5/8 hohlraum with 1521 pC signal in the forth HXRD channel.

There is no signal in HYNTD for shot 45548 and two 40 mV and ~15 mV signals for shot 45549.

These 4 files are new experimental data, the rest is interpretation/estimation/speculation.

1) Hard X-rays have very little or not at all effect for C)2 experiments on OMEGA.

2) Effect on the NIF. Scale 1 hohlraum with gas and face plates produced at 13.6 kJ about 6.6 times less hard X-ray than shot 45549 (see shot 44562, 1521/229 = 6.64). If we assume that hard X-ray signal is proportional to total beam energy, then on NIF we should expect 73.5 times (1000/13.6) higher hard X-ray signal than in shot 44562. Therefore CO2 signal will be 73.5/6.6 = 11.1 times higher on the NIF than on OMEGA. Instead of 40 mV signal it will be 0.44 V signal.

This 0.44 V hard X-ray signal should be compared with gamma ray signal in shot 45045 but scaled to unsplitted signal and different PMT gain. Therefore it will be (0.44V)x2x2 = 1.76 V signal scaled for two splitting and (1.76 V)x10/2.6 = 6.77 V corrected for PMT gain difference.

Shot 45045 has neutron yield 2.78 E12, therefore hard X-ray signal will be on the NIF equivalent to gamma signal from implosion with (2.78)x(0.44/6.77) E12 = 0.18 E12 = 1.8 E11 neutron yield.

So, on the NIF hard X-rays will generate in the CO2 cell shielded with 3 mm tungsten signal equivalent to gamma signal from implosion with 2 E11 neutron yield. Since Gamma Bang Time will be designed for yield greater than 1 E15, contribution from hard X-rays can be neglected.

Conclusion: 3 - 5 mm tungsten is a reasonable shielding for CO2 cell on the NIF, but similar hard X-ray test should be performed on the NIF to prove it. We need such test in case if hard X-rays are not linear with energy.

Thank you,

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From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Monday, September 11, 2006 11:16 PM
To: Hans W. Herrmann
Cc: jmmack; Colin Horsfield
Subject: Re: Oct 4 Shots

Dear Hans,

Thank you for information about shots on October 4, 2006.

I think the main reference diagnostic for your Double Pulse experiment will be NTD, not HYNTD. The 5 E12 yield and time separation between pulses match good NTD parameters.

Our plans are to prepare HYNTD in CO2 option by October. This option is not manufactured yet, we will try to finish it by October, but there is no guarantee. What mode (scintillator or CO2) do you have in mind then you refer to Light Pipe?

If CO2 option will be ready we can run HYNTD in CO2 + only PMT (100% light to PMT) mode. This option is similar to GCD1 but in different geometry. Is this what you want?

You experimental plan looks very challenging for me. Is it a normal or extended shift? It is very difficult (practically impossible) to have 8 Double Pulse + 6 high yield shots in a normal 12 hours shift. You can create 14 SRF (just in case), but count on 10 -12 shots. For shots without SSD you should request 30 kJ energy on target (not 27 kJ).

Thank you,

At 05:33 PM 9/11/2006, Hans W. Herrmann wrote:

Vladimir,

As you know, we will be conducting high-yield DT shots on Oct 4. There will essentially be two sets of experiments:

1. We will start off with Double Pulse experiments looking for structure in the reaction history. The expected yield is <=5e12 neutrons using Hoppe shells (~1000 um diameter, 3.8 um glass wall, 10 atm DT). The pulse width will be 0.6 ns (sg0604). The first pulse will contain 10 kJ in 40 beams, followed by a 5 kJ pulse of 20 beams. The delay between the start of the pulses will vary between 0.7-1.0 ns. For diagnostic setup purposes, implosion times range from 1.3 to 1.5 ns. I expect to run 8 of these shots.

2. The second experiment will be high yield for Neutron Imaging. We could get off as many as 6 of these shots (perhaps more if we decide to abandon the Double Pulse experiment after a few shots due to lack of expected results). There will only be 2 Hoppe shells left after the Double Pulse experiment, which we expect to achieve yields of >5e13 neutrons with a 1.0 ns pulse (sg1018) and 27 kJ (i.e. no SSD). The remaining 4 shells are drop towers, which are expected to give somewhat lower yield, but hopefully >2e13.

I understand Joe is coordinating with you on the Light Pipe which I expect to be extremely useful for diagnosing the Double Pulse experiment.

I look forward to my first Omega PI experience on these upcoming shots and would appreciate any advice you might have in making this go smoothly.

thanks,
Hans

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From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Monday, September 25, 2006 10:32 PM
To: jmmack; Hans W. Herrmann
Cc: lerche1; Mike Moran; Craig Sangster; csto; Colin Horsfield
Subject: Gamma Bang Time and hard X-rays

Dear Joe and Hans,

Since you are presenting some Monte Carlo calculations about GBT this Thursday, I want share some supplemental information from HYNTD.

I want to determine a maximum sensitivity of HYNTD to neutron in scintillator + PMT mode. Something like neutron bang time detector based on Light Pipe.
I run HYNTD with 5 mm scintillator and PMT with 1 E6 gain. I turn HYNTD on earlier just to check data acquisition system and to my surprise recorded some signal in non-neutron shot. First I think that we have a light leak. To check this, we remove scintillator and recorded empty HYNTD on shot 44859. There is no light lead, but there are some 20 mV hits. If this will be a neutron shot, I will say a single neutron hits, but it was no neutrons at all. The shot 44859 and 44861 are Fast Ignition shots with empty plastic shell and Au cone. See slide with target design. Laser beams hit only shell and doesn't hit gold cone. Anyway, there is no neutrons in these shots.
Could somebody explain to me the nature of these 20 mV hits?

It happened that hot electrons from laser interaction with plastic shell interacts with gold cone and produce hard X-rays. See hard X-ray detector output for shot 44861. For this shot HYNTD scintillator + PMT produced 2.5 V signal in each of scope channels (5 V total). For such gold cone targets a 3 mm thick W is not enough. Hard X-rays from gold cone easily penetrate 3 mm tungsten.

I choose 3 mm of W as a hard X-ray shielding because NTD has 2 mm W and we never see hard X-ray signal on NTD in direct drive. (Indirect drive is another story). In some sense this is a "gold" experiment that Joe was talking long time ago.

For the regular direct drive D2 shots without gold cone HYNTD see no X-rays, just a neutron signal. See shot 44863 with D2 yield 3 E9 and 44945 with DT yield 2.8 E10. Therefore, 3 mm W is good for direct drive implosions and not enough for indirect drive.

You may say that this gold cone is very thick and produced more hard X-rays that a normal hohlraum. This is true for scale 1 hohlraum and PS26 pulse. But LLNL is planing to use gas filled hohlraum. And gas may increase hard X-ray signal by 1000 times. See HXRD output for shots 44560 and 44562. Shot 44560 is vacuum scale 1 Au halfraum with PS26 pulse and 13.5 kJ energy. Hard X-ray signal is low. Shot 44562 is gas filled scale 1 Au halfraum with PS26 pulse and 13.6 kJ. As you can see hard X-ray signal in all channels increased by factor of 1000. This is a prise we will pay to increase radiation temperature in halfraum on 17 eV.

You can see that hard X-ray level for shot 44861 is comparable with shot 44562. And this is only for 13 kJ. What kind of hard X-ray signal will be on the NIF?

Yes, you may say that this is a signal from scintillator and from CO2 it will be no signal at all.
But the story with GCD2 make me skeptical. Yes, we need to check signal in CO2 version of HYNTD with indirect drive shots. I will do it at first opportunity.

But then you will optimize GBT converter for the NIF do it after a lead brick!

Thank you,

Dr. Vladimir Glebov,
Senior Scientists,
Laboratory for Laser Energetics,
University of Rochester,

250 E. River Road,
Rochester, NY 14623-1299

Phone 585-275-7454
Fax 585-275-5960

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Wednesday, September 27, 2006 4:17 PM
To: Hans W. Herrmann
Cc: Craig Sangster; Mike Moran; lerche1; Joseph M. Mack; csto
Subject: NTD and HYNTD

Dear Hans,

This is a quick update on status of NTD and HYNTD.

The NTD streak camera was fixed and reinstalled in the Target Bay yesterday.
We recorded fiducial on NTD and will test NTD on a real shots this Friday.
The NTD timing calibration was lost because of streak camera delay was changed after repair. We will try to re-calibrate NTD as soon as possible after next week shots and re-calculate bang time after calibration. But burn width and double pulses (if produced) can be recorded by NTD now. Only absolute bang time is compromised.

I have seen that you ordered a separate fiducial line for GCD1. This is fine in a long run.
But without calibrated NTD on October 4th may you should use the old, calibrated fiber for GCD1.

HYNTD front light pipes were modified for CO2 and tested at 150 psi. We will run HYNTD in scintillator + PMT mode this Friday. Final assembly and in situ test of CO2 version is scheduled on Monday.

Thank you,

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From: Joseph M. Mack [jmmack@lanl.gov]
Sent: Friday, February 25, 2005 2:12 PM
To: Vladimir Glebov
Subject: Re:

Dear Vladimir: Thanks enormously for your response! I (we) agree will all you have written to the point that even before you sent this e-mail I had already made your suggested changes. However, I strongly believe that this suggested gamma campaign MUST have two parallel efforts: one to satisfy the requirements (the **primary** diagnostic) and another to act as a secondary to ensure we collect data on EVERY NIF shot. The **secondary** diagnostic would not necessarily meet ALL requirements. For example it might be the best scope/photo tube system we could field.

I will also add more detail to the already modified Gant chart, but I will not attach specific names, primarily because I have no authority to do so and also MANY of the names WILL change in fairly dynamic ways.

What do you think about Mike's light pipe results?

> Dear Joe,
>
> It is clear from Jeff Koch slides that 4.5.1 Reaction History System is a fusion gamma based diagnostic designed for the highest yield (up to 1 E19, not 5 E18 like in your E-mail).
>
> As far as milestones it is not clear for me why do we need a CDR for RHS in 05 when much more developed nTOF system will have CDR in 06?
> I propose shift CDR from 05 to 06.
> I propose change name of "Develop timing strategy" to "Develop timing calibration strategy". I assume that timing strategy is really how we will cross calibrate RHS with NIF laser in time. There are a lot of unresolved questions in this calibration.
> I don't understand, how we can developed implementation plan before CDR?
> Implementation depends on design very strongly. If it Light Pipe - it is one implementation, if it relay optic - another implementation. So, I propose to shift "Develop implementation plan... " just after CDR for RHS.
> "Calculate backgrounds and estimate noise..." I think background depends a lot on a design, location, and implementation of RHS. This item should be extended up to 08 or 09.
>
> Best regards,
>
> At 04:19 PM 02/23/2005 -0700, Joseph M. Mack wrote:
> Folks: in order to respond to the WBS mtg today I am asking for issue/milestone suggestions from the stakeholders. I recognize up front that I am "slightly" uncertain as to the validity of this part of the process, but we will attempt to do our part.
>
> The most significant boundary condition at the moment is the neutron yield (5E15 - 5E18), which forces us to the upper end of an assumed burn history calculation (Wilson, for example). If this be the case, this part of the exercise involves only fusion gamma ray diagnostics, even though, as many of us believe, the ultimate attempt will involve fusion neutrons, as well. The time response requirement I understand is still "parked" at ~30 ps.

I am NOT in favor of assigning names to the milestones; I will have to come to grips with this in my own way.

Looking forward to your input...I will probably contact each person involved tomorrow.

Thanks ahead of time...

Dr. Vladimir Glebov
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From: Jeff Koch [Koch1@llnl.gov]
Sent: Friday, March 11, 2005 12:54 AM
To: Vladimir Glebov
Cc: csan; Mike Moran; lerche1; Joe Mack; Cindy Christensen
Subject: Re: Agenda: VTC-WBS 4.5/4.6 Planning - 3/9/05

Hi Vladimir, thanks for the comments and good suggestions. Are you thinking of the light-pipe experiments as tests of the front end components (e.g. for NTD, GCD) or of the pipe concept by itself? I guess in my mind they're separable - there are various ways to make light out of fusion products, and various ways to transport this light to a fast optical detector. I guess my major concern is the time resolution capabilities of the light pipe - I can believe that a lens system can be made with high bandwidth without too much difficulty, but I'm less convinced we understand the light pipe, simply because it relies on unknown reflection properties inside the tube. On paper it should work fine, but in practice the tube scatters some light, the reflectivitiy isn't constant at all points inside the tube and isn't really characterized, etc. One could measure this using a short-pulse laser, but if it's possible to do at Omega on a real implosion then all the better.
--Jeff

>Dear Jeff,
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>This is my comment to 4) Plan for RHS-gamma development.
>
>In May 10-11, 2005 it will be high yield DT shots on OMEGA. Two gamma
>ray systems will be tested on OMEGA side by side. One is Gas Cherenkov
>Detector (GCD) from LANL, the other is the Light Pipe from LLNL/LLE.
>In my opinion, plan for RHS-gamma development depends very strongly on
>May results. A draft of the Light Pipe test plan is included for your
>information:
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>This is a draft of a test program for Light Pipe in May.
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>In my opinion, the test program for the Light Pipe in May should
>consists from three tests:
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>The Light Pipe test program can look like this:
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>1) Blue Box installation in La Cave a week before.
> Test of trigger, fiducial, and software.
> Measurement of sweep cards delays.
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>
>We need for such test program:
>
>1) Reentrant tube
>2) Light Pipe hardware
>3) Set of sensors: scintillators, CO2, quartz, lead glass
> Do we need more scintillators?
>4) Steak camera (Blue box with S20 photocathode) with 30x, 10x, 3x
>sweep cards
>5) We need a fixture for streak camera to accommodate Light Pipe and
>fiducial
>6) PC for Blue Box, DAC software
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>At 03:47 PM 03/08/2005 -0800, you wrote:
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>>1) Protex use outside the bay wall for all ignition experiments.
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>>---
>>Jeffrey A. Koch, Ph.D.
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>>---
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---

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Monday, August 07, 2006 9:11 PM
To: Joe Mack
Subject: Fwd: Light Pipe

Dear Joe,

For your information, I am sending to you E-mail with some result of a Light Pipe test.
We (Mike and I) consider this test successful and will try to continue it in May 2005 with reentrant tube for scintillator/lead glass/CO2 cell and Light Pipe in the same hole in a floor. We will use PMT and streak camera. If May test will be successful, we can build a High Yield NTD for OMEGA based on Light Pipe. This also can be considered as a prototype for the NIF.

Best regards,

Date: Mon, 21 Feb 2005 10:24:12 -0500
To: Mike Moran <moran3@llnl.gov>
From: Vladimir Glebov <vgle@lle.rochester.edu>
Subject: Light Pipe and PD040
Cc: lerche1@llnl.gov

Dear Mike,

I am sending to you slides that I presented last Friday in a Diagnostic Development update. Hope slide with possible Light Pipe application will be helpful for you.
In one of the slides I compare signal from Light Pipe scintillator with signal from a 10 mm x 1 mm CVD diamond at 5.4 m from TCC. The Light pipe signal is faster then CVD diamond. See attached files.

Best regards,

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Sent: Monday, August 07, 2006 9:11 PM
To: Jeff Koch
Cc: csan; Mike Moran; lerche1; Joe Mack; Cindy Christensen; Brian MacGowan
Subject: Re: Agenda: VTC-WBS 4.5/4.6 Planning - 3/9/05

Dear Jeff,

The main goal of the Light Pipe tests in May is a test of the pipe concept itself: we want to measure bandwidth and sensitivity of the pipe design. If test will be successful, it may have a practical implementation on OMEGA as a High Yield NTD for OMEGA. Also, if this test will be successful, it will provide an experimental conformation of Mike's calculations that can be adjusted for the NIF. If we will find some problems, we will learn something and will start thinking how to solve these problems.

I am 100% agree with you that if something works fine on paper, it not necessary works in practice. Everybody can remember a lot of such stories. Even Light Pipe appears as a fix up for Fiber Fusion Diagnostic (FFD) that works fine on paper with fiber as a transport media for light. Unfortunately, in practice fiber is sensitive to X-rays and neutrons.
By the way, I am afraid that not everybody at LLNL knows about this fiber deficiency and there are still diagnostics for the NIF that plan to use fibers. Who is a right person at the NIF to check all NIF diagnostics for the fiber deficiency problem?

To solve fiber background problem Mike came with idea of Light Pipe and so far it works fine both in FFD and in separate experiment in February on OMEGA. It looks like Mike is too busy and didn't explain all details of Light Pipe success story at LLNL. I attached one set of slides for the final design review prepared by Mike before OMEGA test and another very short set prepared by me after OMEGA test. Unfortunately, I don't have tools to transfer pictures from postscript to Power point and use old cut and paste technic (with paper) for my presentation. Therefore, I also attached postscript files with actual data. If you compare fits for Light Pipe and 5.4 m CVD diamond signals, you can see that the Light Pipe rise time is faster than 10 mm diameter, 1 mm thick CVD diamond. The Light Pipe fall time is determined by scintillator decay (BC-422 in this shot). This is in agreement with Mike's calculation that we have only one or two light reflections from the pipe and they didn't affect time resolution. We concluded from February tests on OMEGA that with Light Pipe in February configuration we are limited by time resolution of PMT, cables, and scope. In May we will use streak camera to REALLY measure Light Pipe bandwidth.

And there is no X-ray or other background in Light Pipe signal except gamma ray interaction in unshielded PMT AFTER neutron signal from the scintillator. Yes, we loose some light and can receive a much higher signal if attach PMT to scintillator. But in such design we will immediately receive X-ray and gamma background plus EMP noise from cables. See signal for the same shot from 5.4 m nTOF detector. Here you can see in front of DT neutron signal at about 76 ns a lot of hard X ray and gamma signals from implosion and n,gamma interactions with diagnostics, target chamber walls, and structures outside.

I think the Light Pipe technic has many potential application, see my last slide.

As far as traditional relay optics that is used now in NTD and GCD, they, probably, can collect and transfer more light than the Light Pipe. But traditional optics require much more engineering for implementation. Just compare with VISAR on the NIF. Also there is a question of gammas and neutrons interaction with lenses. One of the question for May test - do we have enough signal from the Light Pipe (and do we have enough

bandwidth) ?

Best regards,

At 04:53 PM 03/10/2005 -0800, Jeff Koch wrote:

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From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Wednesday, October 25, 2006 12:35 AM
To: Joseph M. Mack
Subject: Light Pipe FDR

Dr. Vladimir Glebov,
Senior Scientists,
Laboratory for Laser Energetics,
University of Rochester,

250 E. River Road,
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Phone 585-275-7454
Fax 585-275-5960

From: Vladimir Glebov [vgle@lle.rochester.edu]
Sent: Thursday, February 15, 2007 4:01 PM
To: Hans W. Herrmann
Cc: Joseph M. Mack; Colin Horsfield; Carl Young; Mike Moran; Richard Lerche; Craig Sangster
Subject: Light Pipe update
Attachments: LP NBT.ppt; 46533_hyntdpmt.pdf

Dear Hans,

I received a voice message from you asking to Light Pipe update and participation in GBT Physics Review.
I believe, you all have October 2006 CO2 data. Since October, I used CO2 in Light Pipe only once to collect hard X-ray data. I believe, I sent all these data and my conclusions also.

Right now I developing Light Pipe NBT. See attached slides and shot 46533 with 2 E9 yield. This is a backup diagnostic for OMEGA in case of very high EMP in fast ignition experiments. You can also use LP NBT as backup diagnostic for the NIF in case if bang time measurements with X-ray diagnostics will fail. But LP NBT will require a removable re-entrant tube up to about 50 cm from TCC. It is still unclear for me if this is possible.

I will phone Joe Mack after VTC.

Thank you,

--
Dr. Vladimir Glebov
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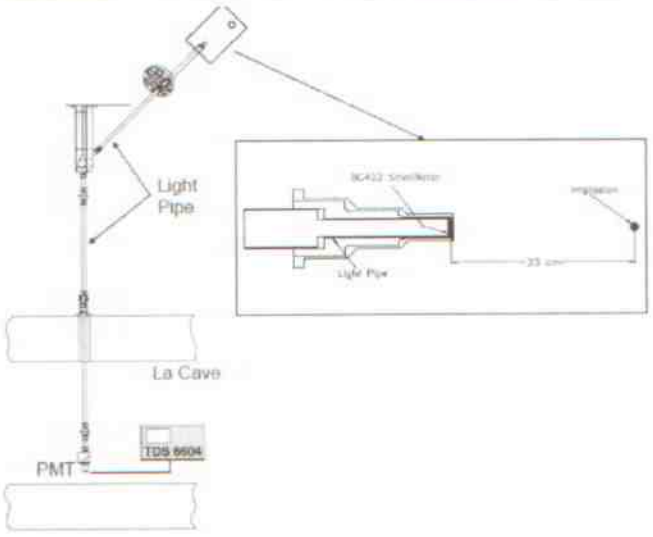
The Light Pipe for HYNTD can be used in 4 diagnostics for combined OMEGA – OMEGA EP experiments

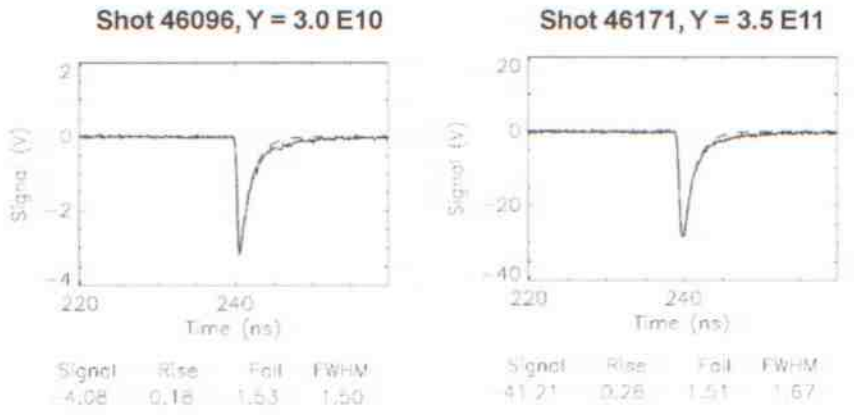
- HYNTD = scintillator @ 23 cm + Light Pipe + ROSS
  - Needs ROSS shielding
  - Solve discrepancy in burn width with NTD
- GBT = CO2 cell + Light Pipe + PMT + scope
  - Platform for GBT development for the NIF
  - It is operational since October 2006
- LP NBT = scintillator @ 23 cm + Light Pipe + PMT + scope
  - Was tested last week
  - Can be EMP shielded NBT
- nTOF = scintillator @ 450 cm + Light Pipe + PMT + scope
  - In a design stage
  - Can be EMP shielded nTOF detector

Light Pipe NBT has the same configuration as HYNTD with PMT and scope instead of ROSS



UR 008877

The Light Pipe NBT was tested in D_2 implosions in January 2007



Expected yield range of LP NBT is from 1 E9 to 1 E15